MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

(UGC AUTONOUMOUS – Govt. of INDIA)

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

Introduction to Aerospace Engineering (R-17)

MODEL PAPER – I

MAXIMUM MARKS: 75

Year: II YR/ Sem I

MODEL PAPER I

PART A Marks : 25

ANSWER ALL THE QUESTIONS

1. (a) Explain lighter than air aircraft concept with a neat sketch

   (b) Explain Meteorites and micrometeoroids

   (c) Explain the control surfaces of an aircraft

   (d) Explain in brief about missile and launch vehicle

   (e) Explain about stalling speed and give the required equation

   (f) Enumerate the moment coefficient about CG and give equation for trimmed condition

   (g) Discuss the satellite missions

   (h) Discuss about EVA

   (i) Explain about design process

   (j) Discuss in brief about CAD

PART B 50Marks

ANSWER FIVE QUESTIONS

2. Explain the evolution of jet engines and aircrafts

   or

3. Explain the structure of magnetosphere and effects of environmental impact on spacecraft design
4. Explain the various components, types and working principle of a helicopter

   or

5. Explain with a neat sketch the working principle of a jet engine.
6. Consider an aircraft flying approximately at 1500 m altitude with
   case 1: A_a= 15m^2; c=1.6m; A=2.3m^2; l_t=1600kg.m^2; a_w=5rad^{-1}; $C_{M,ac}$=-0.07; ε=0.45; V=50 m/s; a_t= 4 rad^{-1} ;ρ=1kg/m3 . calculate is the neutral point of a/c.
   case2: let CG is placed halfway between ac and neutral point, x_a=0.21m and $x_{a/c}$=0.132. calculate the angle of attack of the tail and lift produced by tail.

or

7. Derive the equation of motion for pull up and pull down maneuver.
8. Discuss about the Apollo mission with its phases in mission.

or

9. Explain about power systems and thermal control in a satellite
10. Explain about drawing techniques available

or

11. Discuss about orthographic and perspective projections and discuss their difference.

MODEL PAPER II

PART A
ANSWER ALL THE QUESTIONS 25 M

1. (a) Explain few points about exploring solar system

   (b) Explain about dirigibles

   (c) Explain the working principle of a turbojet engine

   (d) Explain about inlet and derive equation for inlet efficiency
   (e) Explain about gliding flight with required equation

(f) Discuss about dynamic stability with required graph
(g) Operational roles of propulsion system of satellite
(h) Discuss five points on skylab
(i) Discuss about orthographic projection
(j) Discuss in brief about CAM

PART B

ANSWER FIVE QUESTIONS 50M

2 Discuss few points on the history of aviation

or

3 Explain about planetary environments within the solar system

4 Derive the equation of buoyancy lift

or

5 Derive the equation of thrust of a jet engine.

6 Define the airplane geometry with a neat sketch and discuss about the two types of stability in detail.

or

7 Derive the equation for maximum lift-to-drag ratio.

8 Discuss about the Gemini mission

or

9 Derive the rocket thrust equation

10 Explain about CAE

or

11 Explain about- Conceptual, preliminary and detail design process.

MODEL PAPER III

PART A

ANSWER ALL THE QUESTIONS 25 M

1. Explain the success of first hot balloon 2M
2. Explain about van Allen belts 2M
3. Explain about compressor and its types, derive equation for CPR and work done 3M
4. Discuss the effect of CD and CL with α 2M
5. Discuss about static stability 2M
6. Discuss the thrust velocity curves and give equation for C_D 3M
7. Discuss 5 points on ADCS 3M
8. Discuss few points on shuttle-mir mission 2M
9. Discuss about orthographic projection 2M
10. Discuss in brief about CAM 3M

PART B

ANSWER FIVE QUESTIONS 5X10=50M

1. Explain few points on the advances took during jet engine development

   or

   Explain the types of heat transfer methods and derive expression for equilibrium $P_{emitted}$, $P_{absorbed}$ temperature of any body at a distance d from sun.
2. Explain the various types of drag with neat sketches

   or

   Explain with a neat sketch the components & working principle of ramjet engine.
3. Derive the endurance and range equation for a propeller and jet engine.

   or

   derive the equation for trimmed angle of attack.
4. Explain in detail about mercury mission.

   or

   Discuss about the elements of a satellite system.
5. Explain about drawing techniques available

   or

   Discuss about orthographic and perspective projections and discuss their difference.

MODEL PAPER IV

PART A

ANSWER ALL THE QUESTIONS 25 M

1. Explain few points regarding the first aircraft in the history by Wright brothers
   2M
2. Explain in brief the layers of atmosphere
   3M
3. Explain about induces drag and methods to reduce with neat sketch and give required equations
   3M
4. Explain about nozzle and types with a neat sketch
   2M
5. Discuss about range and endurance of an a/c
   2M
6. Discuss the airplane axis system with a neat sketch
   3M
7. Explain and give equation for power budget of a satellite
   3M
8. Discuss about planetary EVA
   2M
9. Explain about design process
   2M
10. Discuss in brief about CAD
    3M

PART B

ANSWER FIVE QUESTIONS 5X10=50M

1. Explain the attempts and success during space exploration

   or

   Explain the terms

   a. GCR b. Microgravity c. Solar activity d. Solar flares

2. Explain the terms

   a. Aspect ratio b. Airfoil nomenclature c. Symmetric airfoil d. Cambered

   or

   Derive equation governing propeller propulsion.

3. Derive the equation for longitudinal static stability

   or

   Discuss about accelerated flight and derive required equations.
4. Discuss about the spacesuit design, and discuss the difference between US and Russian.

   or

   with neat sketch explain the working of a ADCS
5. Explain about CAE

   or

   Explain about- Conceptual, preliminary and detail design process.

MODEL PAPER V

PART A

ANSWER ALL THE QUESTIONS 25 M

1. Discuss few points on the first man attempts to fly by Icarus and Deadalus
   2M
2. Discuss few points on GEO
   3M
3. Explain about overall efficiency and discuss all terms
   2M
4. Discuss about profile drag and give required equations
   3M
5. Explain the condition of steady flight with equations
   2M
6. Discuss and give equation for the resulting motion on an aircraft
   3M
7. Explain and give equation for $P_{emitted}$ and $P_{absorbed}$.
   2M
8. Discuss the functions of LSS
   3M
9. Discuss about isometric projections
   3M
10. Explain about personal design portfolio
    2M

PART B

ANSWER FIVE QUESTIONS 5X10=50M

1. Explain from the dawn how the improvements that took in aerospace industry from wright flyer to current black bird

   or

   Explain the different layers of atmosphere with a graph showing the temperature and pressure variation

2. Explain the different types of combustor and turbine, derive equations BPR, f, TPR, W_{turb}.

   OR

   a. Explain what is a pitot static tube, position in aircraft and the use.
   b. Using Bernoulli principles derive the equation for stagnation pressure, flow speed.

3. Discuss the V-n diagram with required equations

   or

   Define the airplane geometry with a neat sketch and discuss about the two types of stability in detail.
4. Explain about space shuttle mission and space shuttle with mir, their achievements and mission procedures

   or

   discuss the elements of satellite in detail
5. Explain about LTA design process and point on how LTA takes flight .

   or

   Explain about ornithopter design and CDR

UNIT I: History of Flight-The Aerospace Environment:

Evolution of Flight-Usage ofBalloons, dirigibles-Heavier than air aircraft:

Early Aviation period is from 1783 till 1915.

The development can be grouped as

- Balloons
- Derigibles
- Airships

Flying Vehicles can be broadly classified as

- Lighter-than-air aircraft
- Heavier-than-aircraft

Manned Flight began in France in 1783. Joseph and Etienne Montgolfier invented the “hot air Balloon”

From the balloon, came dirigibles, the addition of power and controls and other developments.

Lighter-than-aircraft: Montgolfier brothers built the first hot air balloon in Apr 1783.

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II B.Tech I Semester Examination AERO Department
ELECTRICAL AND ELECTRONICS ENGINEERING
MODEL PAPER-I

Time: 3 hours **Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1)a) With a neat diagram explain the working principle of permanent magnet moving coil instrument. [7]

b) Write the advantages and disadvantages of PMMC instruments. [7]

OR

2) Determine the current in the unbalanced bridge circuit shown in Figure 1. Find the value and direction of current through the galvanometer. Neglect the internal resistance of the battery. [14]

SECTION-II

3)a) Derive the Torque equation of DC Motor [7]

b) Explain the basic principle of operation of D.C Motor [7]

OR

4) A 25kW,250v dc shunt generator has armature and field resistance of 0.06Ω and 100Ω respectively.Determine the total armature power developed and efficiency when working

a) As a generator delivering 25kW output and [7]

b) as a motor taking 25kW input. [7]

SECTION-III

5)a) Explain the working principle of a single phase transformer with a phasor diagram. [3]

b) Define voltage regulation and efficiency of a transformer. [4]

c) The full load copper and iron losses of a 15KVA, 1Ø, transformer are 320W and200W respectively. Calculate the efficiency on

i) full load

ii) half load

When load power factor is 0.8 lagging in each case. [7]

OR

6) Explain how regulation of an alternator can be estimated by synchronous impedance method [14]

SECTION-IV

7) Explain the principle of operation of half wave bridge rectifier and draw the wave forms.[14]

OR

8) Draw the basic band structure of NPN and PNP transistors and explain its operation. [14]

SECTION-V

9) Derive the expression for magnetic deflection sensitivity of a Cathode ray tube. [14]

OR

10) With the help of block diagram explain the working principle of a CRT. [14]

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II B.Tech I Semester Examination AERO Department

ELECTRICAL AND ELECTRONICS ENGINEERING

MODEL PAPER-II

Time: 3 hours **Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1)a) A 10Ω resistor is in series with a parallel combination of two resistors 15Ω and 5Ω. If the current in the 5Ω resistor is 6A, what is the total power dissipated in the three resistors? [7]

b)State and explain Kirchhoff's laws [7]

OR

2)a) What are the different types of electrical measuring instruments? [7]

b) Explain about different types controlling torques. [7]

SECTION-II

3)a) Explain the basic principle of D.C generator. [7]

b) A 6 pole wave wound D.C generator is having 50 slots with 25 conductors per slot and rotating at 1500 rpm.The flux per pole is 0.015 Wb, calculate the emf generated. [7]

OR

4)a) Write the similarities and dissimilarities between the motor and generator. [7]

b) The power input to a 230v dc shunt motor is 8477kw.The field resistance is 230Ωand armature resistance is 0.28Ω find input current, armature current and back emf. [7]

SECTION-III

5)A 3phase 6 pole, 50 Hz cage motor is running with a slip of 4%. Find,

a) Speed of rotating field relative to stator winding. [2]

b) Motor speed. [2]

c) Slip speed. [2]

d) Frequency of the emf induced in the rotor. [2]

e) Speed of rotation of rotor mmf relative to rotor winding. [3]

f) Speed of rotor mmf relative to stator winding [3]

OR

6)a) Explain the principle of operation and derive the emf equation of transformer. [7]

b) A single phase 2300/230 V, 50 Hz core type transformer has core section of 0.05 m_2. If the permissible maximum Flux density is 1.1wb/m2, calculate the number of turns on primary& secondary sides [7]

SECTION-IV

7) Draw V-I characteristics of p-n diode and justify your answer with the help of a neat circuit diagram explain the working principle of Single phase full wave rectifier.What is ripple factor and obtain the ripple factor for single phase full wave rectifier. [14]

OR

8)a) Mention any four applications of PNP transistors. [7]
b) Explain the principle of operation of SCR. [7]

SECTION-V

9) Derive the expression for magnetic deflection sensitivity of a Cathode ray tube. [14]

OR

10) Name different components of CRT and write the function of each component. [14]

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II B.Tech I Semester Examination AERO Department

ELECTRICAL AND ELECTRONICS ENGINEERING

MODEL PAPER-III

Time: 3 hours **Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1) Discuss the different types of torques required in an indicating instruments [14]

OR

2)a) Three resistances are connected in star, determine its equivalent delta configuration. [7]
b) Derive the relation for conversion from delta to star connection. [7]

SECTION-II

3)a) Explain back emf in DC motor [7]
b) A 4 pole lap wound dc machine has 628 armature conductors. The flus per pole is 0.04wb.the total armature current is 110A.find the torque developed [7]

OR

4)a) A long shunt compound generator delivers a load current of 5A at 500V and has armature, series, field and shunt field resistance of 0.05Ω, 0.03Ω and 250Ω respectively. Calculate the generated voltage and the armature current .allow 1v per brush for contact drop. [7]
b) Explain the OC characteristics of DC generator. [7]

SECTION-III

5) A single phase 10 KVA, 2000/200 V, 50Hz transformer has impedance drop of 10% and resistance drop of 5 %. Find the voltage regulation:
a) At full load at 0.8 power factor lagging. [3]
b) At half the F.L at 0.6 Pf leading [4]
c) An ideal 25kVA transformer has 500turns on the primary winding and 40 turns on the secondary winding. The primary is connected to a 3000V, 50Hz supply. Calculate
i) Primary and secondary currents on full load
ii) Secondary emf
iii) The maximum core flux. [7]

OR

6)a) Explain the construction and working principle of three phase alternator. [7]
b) Draw the slip-torque characteristics of a 3-phase Induction motor and justify your answer with the suitable formulae. [7]

SECTION-IV

7)a) Explain the operation of a full wave bridge rectifier. [7]

b) A single phase 230V, 1 kW heater is connected across single-phase 230V, 50Hzsupply through a diode. Calculate the power delivered to the heater element [7]

OR

8)a) Discuss the characteristics of P-N junction diode [7]

b) Explain the transistor as an amplifier [7]

SECTION-V

9) Explain the working of CRT with a block diagram [14]

OR

10) Discuss voltage, current and frequency measurement using CRO. [14]

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II B.Tech I Semester Examination AERO Department

ELECTRICAL AND ELECTRONICS ENGINEERING

MODEL PAPER-IV

Time: 3 hours **Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1)a) Explain the construction details and working principle of attraction type moving iron instruments with the help of neat diagram. [7]

b) Explain the eddy current damping with neat diagram. [7]

OR

2)a) Find the equivalent resistance across AB in the circuit shown below. All the resistances are equal to 5Ω. [7]

b) For the circuit shown in the fig find the total current and the magnitude of the impedance.[7]

SECTION-II

3) With a neat sketch explain the purpose of 3-point starter used in dc motor. [14]

OR

4)a) Describe with the suitable sketches the main parts of a DC machine.Explain the main functions of each part making specific reference to the properties of the material used for the construction of each part. [7]

b) A 250v short shunt compound generator is delivering 80 A.the armature series and shunt field resistance are 0.05Ω and 0.03Ω respectively calculate the voltage induced allowing a brush drop of 2v. [7]

SECTION-III

5) Explain the working principle of a 3 phase induction motor [14]

OR

6)a) Define voltage regulation and efficiency of a transformer. [7]

b) A single phase 2200/250 V, 50 Hz transformer has a net core area of 36 sq.cm and a maximum flux density of 6 Wb/m2. Calculate the number of turns of primary and secondary windings. [7]

SECTION-IV

7)a) Explain the principle of operation of SCR [7]

b) Explain how a transistor is used as an amplifier [7]

OR

8) Explain the working principle of full bridge rectifier and obtain the formula for its ripple factor [14]

SECTION-V

9) Write the principle of operation of CRT [14]

OR

10) Derive the expression for electrostatic deflection sensitivity of a Cathode ray [14]

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II B.Tech I Semester Examination AERO Department

ELECTRICAL AND ELECTRONICS ENGINEERING

MODEL PAPER-V

Time: 3 hours **Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1) Discuss the different types of torques required in an indicating instruments [14]

OR

2) Discuss the different types of torques required in an indicating instruments [14]

SECTION-II

3)a) Give the applications of dc compound motors. [7]

b) A four pole 220v dc shunt motor has 540 lap wound conductors.it takes 32A from the supply mains and develops power of 5.59kw.the field winding takes 1A. The armature resistance is 0.9Ω and the flux per pole is 30 mwb calculate the speed and torque developed [7]

OR

4) A 4 pole long shunt lap wound generator supplies 25 kw at a terminal voltage of 500v. The armature resistance is 0.03Ω, series field resistance is 0.04Ω and shunt field resistance is 200Ω. The brush dropis taken as 1v determine

a) theemf generated [7]

b) cu losses and iron losses [3]

c) efficiency at full load [4]

SECTION-III

5)a) Explain different types of losses in a transformer and write their significance in deciding the rating of a transformer. [7]

b) A 25 KVA,2200/220v 50Hz single phase transformer has the following resistance and leakage reactance R_1=0.8Ω,X_1=3.2Ω,R_2=0.01Ω, X2=0.03Ω calculate the equivalent resistance and reactance refered to secondary side. [7]

OR

6)a) Explain the working principle of a Alternator [7]

b) Explain the working principle of a 3 phase induction motor [7]

SECTION-IV

7) Draw the basic band structure of SCR and explain its operation [14]

OR

8) Explain the principle of operation of half wave bridge rectifier and draw the wave forms[14]

SECTION-V

9) Explain the application of CRO in the field of electrical measurements. [14]

OR

10) Discuss how voltage, current and frequency are measured with CRO [14]

II B. Tech II Semester Examination
AIRCRAFT MATERIALS AND PRODUCTION TECHNOLOGY
MODEL PAPER-I

Time: 3 hours **Marks: 70**

UNIT-I

1. Explain the steps and procedure involved in shell molding. Also discuss the advantages and disadvantages of shell molding.
2. (a) Explain about the types of cylinders and hoses used in gas welding with a tabular column for each and required figures.
   (b) Explain the process involved and types of flames in gas welding.

UNIT-II

3. Explain about any one type of drilling m/c in detail. And discuss about the twist drill nomenclature
4. Explain in detail about the various types of sheet metal operations with one example for each.

UNIT-III

5. Explain the AJM machining process; electrode used its advantages and disadvantages.

(or)

6. Explain the EDM machining process its advantages and disadvantages.

UNIT-IV

7. (a) Explain the requirement and advantage of heat treatment & surface finishing.
   (b) Discuss the process of anodizing of titanium alloys

(or)

8. Explain the terms with neat sketches
   a. Organic coating b. Honing c. Polishing & Buffing

UNIT-V

9. Explain about the process of liquid penetrate testing and it types with neat sketches and required equations.

(or)

10. Explain about the types and uses of jigs and fixtures employed in aircraft assembly.

II B. Tech II Semester Examination
AIRCRAFT MATERIALS AND PRODUCTION TECHNOLOGY
MODEL PAPER-II

Time: 3 hours **Marks: 70**

UNIT-I

1. Explain the steps and procedure involved in die casting. Also discuss the advantages and disadvantages of die casting.

(or)

2. Explain the types and process involved in resistance welding with neat sketches.

UNIT-II

3. Explain about any one type of milling machine and the procedure of milling (up & down) in detail.

(or)

4. Explain the terms with neat sketch
   a. Bending b. Super plastic forming
   c. deep drawing d. Louvering [2 ,3, 2, 3]

UNIT-III

5. Explain the laser machining process; electrode used its advantages and disadvantages.

(or)

6. Explain the ECM machining process its advantages and disadvantages.

UNIT-IV

7. a) Explain the requirement and advantage of heat treatment & surface finishing.
   (b) Discuss the process of heat treatment of aluminum alloys

(or)

8. Draw and explain about iron carbon diagram its compositions and variations in percentage effects.

UNIT-V

9. Explain the various types of project related tools used in aircraft assembly.

(or)

10. Explain about the process of magnetic particle testing and it types with neat sketches and required equations.

II B. Tech II Semester Examination
AIRCRAFT MATERIALS AND PRODUCTION TECHNOLOGY
MODEL PAPER-III

Time: 3 hours **Marks: 70**

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1) Explain the principle of Electronic Beam welding with neat sketch.

(OR)

2) Explain about gas welding in details with neat sketch.

3) Explain about quick return mechanism in shaper machine

(OR)

4) Explain about radial milling machine with neat sketch

5) Explain about USM in detail with the help of neat sketch

(OR)

6) Explain why the mechanical properties of work piece materials are not significant in most of the NTMM

7) Discuss the alloying elements which improves strength of pure titanium

(OR)

8) Discuss the process of anodizing of aluminum alloys

9) Explain different mechanical clamping system used in fixtures

(OR)

10) How is metal inspected by ultrasonic testing and x-rays

II B. Tech II Semester Examination
AIRCRAFT MATERIALS AND PRODUCTION TECHNOLOGY
MODEL PAPER-IV

Time: 3 hours **Marks: 70**

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1) Explain the soldering and brazing techniques

(OR)

2) Explain about die-casing in detail with neat sketch

3) Describe "Metal Spinning" write its product applications, differentiate between cold and hot Metal spinning.

(OR)

4) Explain the roll and importance of CNC machine in the field of aircraft industry

5) Explain about EDM in detail with the help of neat sketch

(OR)

6) Explain about EBM & PAM in detail with the help of neat sketch

7) Explain how aluminum alloys classified when used for aircraft application

(OR)

8). Explain the initial stresses and the stress alleviation procedures in manufacturing

9) How is metal inspected by ultrasonic testing and x-rays

(OR)

10) Explain the various types of rivets that are used in an aircraft industry justify your answer with Respect to the loads and atmospheric affects over an aircraft.

II B. Tech II Semester Examination
AIRCRAFT MATERIALS AND PRODUCTION TECHNOLOGY
MODEL PAPER-V

Time: 3 hours Marks: 70

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1) Explain in detail about Centrifugal casting with neat sketch.

(OR)

2) Explain about Investment casting in detail with neat sketch

3) What are the various methods of bending, describe each with neat sketch

(OR)

4) Compare "Metal spinning" with deep drawing

5. Explain about ECM in detail with the help of neat sketch

(OR)

6. List the principle advantages of
   A) Arc welding over gas welding
   B) Gas welding over arc welding

7) A) why the cleaning of a joint is important before welding?
   B) Explain about welding techniques

(OR)

8) Explain about sand casting in detail

9) Explain the tooling docks/tooling bars method in jig alignments

(OR)

10) what are advantages of using jigs and fixture in aircraft manufacturing

MODEL PAPER – I

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

THERMODYNAMICS (R17)

Max Marks: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 14M.

1Q A steam turbine receives steam at 20 bar and superheated by 80 C. The exhaust pressure is 0.10 bar and expansion takes place isentropically. Calculate

a) Heat supplied, assuming that the feed pump supplies water to the boiler at 20 bar,
b) Heat rejected,
c) Turbine work,
d) Net work,
e) Thermal efficiency, and
f) Theoretical steam consumption.

OR

2Q a)Describe diesel gas power cycle with the help of P-V and T-S diagrams. Derive an expression for its air standard efficiency

b) A diesel engine has a clearance volume of 220 **cm3** and a bore and stroke of 15 cm and 20cm respectively. The inlet conditions are 100 KN/**m2** and 20 C. The maximum temperature of the engine is 1400 C. Calculate

i. Ideal thermal efficiency of cycle and
ii. m.e.p

3Q a)What is critical point ? What process is possible below the critical point ?

b)Steam initially at 1.5 Mpa, 300 C expands reversibly and adiabatically in a steam turbine to 40 C. Determine the ideal work output of the turbine per kg of steam.

OR

4Q a)Explain "internal energy", "heat and work"

b)To a closed system 100 KJ of work is supplied. If the initial volume is 0.5 **m3** and pressure of a system changes as P=(8-4V), where P is in bar and V is in **m3**, determine the final volume and pressure of the system.

5 Qa)Prove that at adiabatic saturation t**db = t**wb = t*

b) A mixture of ideal air and water vapour at a dbt of 22 C and a total pressure of 730 mmHg abs. has a temperature of adiabatic saturation of 15 C. Calculate

i. The specific humidity in gms per kg of dry air
ii. The partial pressure of water vapour
iii. The relative humidity, and
iv. Enthalpy of the mixture per kg of dry air.

OR

6Q 0.2 **m3** of air at 3 bar and 120 C is contained in a system. A reversible adiabatic expansion takes place till the pressure falls to 1.5 bar. The gas is then heated at constant pressure till enthalpy increases by 75 kJ. Calculate the work done and the index of expansion, if the above processes are replaced by a single reversible polytropic process giving the same work between the same initial and final states.

7Q a) What is a PMM2 ?

b)A heat pump operates between two identical bodies of specific heat C and T**1**. The operation of the pump cools down one of the bodies to T**2.** Show that for the operation of pump the minimum work input is given by

$$W_{min} = C [T1/T2 + T2 - 2T1]$$

OR

8Q a)Show that energy of an isolated system remains unchanged ?

b)A system comprises a stone of mass 20 kg and a drum containing 1000 kg of water. Initially the stone is 50 m above the water and the stone and water are at the same temperature. The stone is then made to fall into water. Determine change in internal energy, kinetic energy, potential energy heat transfer, and work transfer for the changes of state given below ?

i. The stone is to just enter water.
ii. The stone just comes to rest in drum, and
iii. The heat transferred to surroundings is such that water and stone remain in the same temperature. Assume g = 9.81 m/**s2**

9Q One kg of air at 27 C is heated reversibly at constant pressure until the volume is doubled and then heated reversibly at constant volume until the pressure is doubled. For a total path find work, heat transfer and changed in entropy.

OR

10Q Draw T-S diagram of water and show dew point temperature, dry bulb temperature and critical temperature.

MODEL PAPER – II

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

THERMODYNAMICS (R17)

Max Marks: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 14M.

Q1

a) State the limitations of the first law of thermodynamics.
b) A reversible heat engine operates between 875K and 310K and deliver a reversible refrigerator operating between 310K and 255K. the engine receives 2000KJ of heat and the net work output from the arrangement equals to 350KJ. Calculate the cooling effect of refrigerator.

OR

Q2 Steam at 0.8 Mpa, 250 C and flowing at the rate of 1 kg/s passes into a pipe carrying wet steam at 0.8 Mpa, 0.9 dry. After adiabatic mixing the flow rate is 2.5 kg/s. determine the condition of steam after mixing. The mixture is now expanded in a frictionless nozzle isentropically to a pressure of 0.4 Mpa. Determine the velocity of the steam leaving the nozzle. Neglect the velocity of steam in the pipe line..

Q3 Steam at a pressure of 15 bar and 250 C is delivered to the throttle of an engine. The steam expands to 2 bar when release occurs. The steam exhaust takes place at 1.1 bar. A performance test gave the result of the specific steam consumption of 12 kg/kwh and a mechanical efficiency of 80%. Determine

a) Ideal work or the modified Rankine engine work per kg
b) Efficiency of the modified Rankine engine or ideal thermal efficiency
c) Indicated and brake work per kg
d) Brake thermal efficiency
e) Relative efficiency on the basis of indicated work and brake work.

OR

4Q (a) Derive energy equation for a closed system undergoing

i. Isochoric process
ii. Isothermal process
iii. Polytropic process between state 1 to state 2.

b) When a closed system executes a certain non flow process the work and heat interactions per degree rise in temperature at each temperature attained are given by dW/dT=(4-0.08T)KJ/KdQ/dt=1.00KJ/K. calculate for the increase (or) decrease in the internal energy of the sytem if it is to operate between the temperature limits of 200 C and 500 C.

5Q A rigid vessel of volume 0.86 m^3 contains 1 kg of steam at a pressure of 2 bar. Evaluate the specific volume , temperature ,dryness fraction, internal energy, enthalpy and entropy of steam.

OR

6Q (a) What is heat pump? How does it differ from refrigerator? Explain the COP of both the cases.

(b) A cyclic heat engine operates between a source temperature of 800°C and a sink temperature of 30°C. What is the least rate of heat rejection per kW net output of the engine?

7Q (a) Draw the phase equilibrium diagram for a pure substance on T-s plot with relevant constant property lines

(b) A vessel of 0.04 m^2 Contains a mixture of saturated water and saturated steam at a temperature of 250°C. The Mass liquid present is 9kg . Find pressure, the mass, the specific volume, the enthalpy and entropy and the internal energy

OR

8Q (a) What do you understand by triple point? Give the pressure and temperature of water at its triple point.

(b) Find the enthalpy and entropy of steam when the pressure is 2 MPa and the specific volume is 0.09 m^3/kg.

9 Q (a) Describe diesel gas power cycle with the help of P-V and T-S diagrams. Derive the expressions for its air standard efficiency and mean effective pressure.
(b) A diesel engine has a clearance volume of 220 cm3 and a bore and stroke of 15 cm and 20 cm respectively. The inlet conditions are 100 kN/m2 and 20°C. The maximum temperature of the engine is 1400°C. Calculate,
(i) Ideal thermal efficiency of cycle
(ii) Mean effective pressure.

OR

10 Q(a) Discuss the advantages and disadvantages of vapour absorption refrigeration system over the vapour compression system.

(b) A Bell-Coleman refrigeration cycle works between 1 bar and 6 bar. Find the C.O.P of the system and its tonnage when the air flow rate is 1 kg/s. The ambient temperature is 27°C and refrigerator temperature is 0°C.

MODEL PAPER – III

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

THERMODYNAMICS (R17)

Max Marks: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 14M.

1Q (a) Distinguish between the terms change of state, path and process.
(b) Show that energy is a property of a system. And explain with suitable figures.

OR

2Q The air speed of a turbo jet engine in flight is 270 m/s. Ambient air temperature is 15°C. Gas temperature at outlet of nozzle is 600°C. Corresponding enthalpy values for air and gas are respectively 26 and 912 kJ/kg. Fuel air ratio is 0.0190. Chemical energy of the fuel is 44.5 MJ/kg. Owing to incomplete combustion 5% of the chemical energy is not released in the reaction. Heat loss from the engine is 21 kJ/kg of air. Calculate the velocity of the exhaust jet

3Q A reversible heat engine operates between two reservoirs at temperatures of 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 40°C and 20°C. The heat engine is 2000 kJ and the network output of the combined engine refrigerator plant is 360 kJ.

(i) Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40°C.
(ii) Reconsider (a) Given that the efficiency of the heat engine and the COP of the refrigerator are each 40% of their maximum possible values

OR

4Q (a) What do you understand by triple point? Give the pressure and temperature of water at its triple point.

(b) Find the enthalpy and entropy of steam when the pressure is 2 MPa and the specific volume is 0.09 m^3/kg.

5 Q(a) Discuss the advantages and disadvantages of vapour absorption refrigeration system over the vapour compression system.
(b) A Bell-Coleman refrigeration cycle works between 1 bar and 6 bar. Find the C.O.P of the system and its tonnage when the air flow rate is 1 kg/s. The ambient temperature is 27°C and refrigerator temperature is 0°C.

OR

6Q(a) Describe diesel gas power cycle with the help of P-V and T-S diagrams. Derive the expressions for its air standard efficiency and mean effective pressure.
(b) A diesel engine has a clearance volume of 220 cm3 and a bore and stroke of 15 cm and 20 cm respectively. The inlet conditions are 100 kN/m2 and 20°C. The maximum temperature of the engine is 1400°C. Calculate,
(i) Ideal thermal efficiency of cycle
(ii) Mean effective pressure.

7Q. (a) What is heat pump? How does it differ from refrigerator? Explain the COP of both the cases.
(b) A cyclic heat engine operates between a source temperature of 800°C and a sink temperature of 30°C. What is the least rate of heat rejection per kW net output of the engine?

OR

8Q (a) Draw the phase equilibrium diagram for a pure substance on T-s plot with relevant constant property lines

(b) A vessel of 0.04 m^2 Contains a mixture of saturated water and saturated steam at a temperature of 250°C. The Mass liquid present is 9kg . Find pressure, the mass, the specific volume, the enthalpy and entropy and the internal energy.

9Q a) show that the Claussius statement and Kelvin Planck statement are same
b)To aclosed systems 100 kJ of work is supplied. If the initial volume is 0.5 m^3 and pressure of a system changes as P = (8-4 V), where P is in bar and V is in m^3, determine the final volume and pressure of the system.

OR

10Q Steam at 0.8 MPa, 250 °C and owing at the rate of 1 kg/s passes into a pipe carrying wet steam at 0.8 MPa, 0.9 dry. After adiabatic mixing the flow rate is 2.5 kg/s. Determine the condition of steam after mixing. The mixture is now expanded in a frictionless nozzle isentropically to a pressure of 0.4 MPa. Determine the velocity of the steam leaving the nozzle. Neglect the velocity of steam in the pipe line

II B.TECH I SEMESTER AERONAUTICAL ENGINEERING

MECHANICS OF SOLIDS (R18)

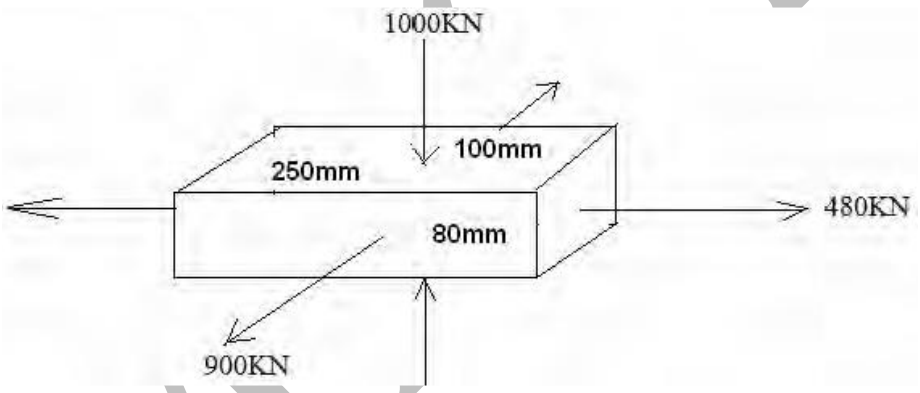
MODEL PAPER – I

Max Marks: 70

Section I

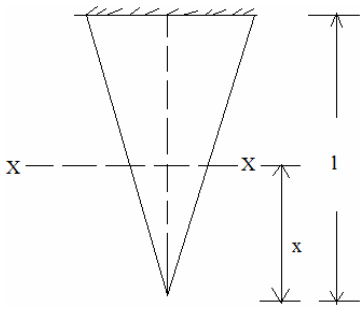
1. a) A rectangular block 250 mm × 100 mm × 80 mm is subjected to axial loads as follows:
   i) 480KN tensile in the direction of its length
   ii) 900KN tensile on the 250mmx80mm faces
   iii) 100KN compressive on the 250mmx100mm faces.

Assuming Poisson's ratio as 0.25, Find in terms of the modulus of Elasticity E of the material, the strains in the direction of each force, If $E=2.0x10^5$ N/mm^2, Find the values of the modulus of rigidity and bulk modulus for the material of the block. Also, calculate the change in the volume of the block due to the applications of the loading specified in Fig.1.



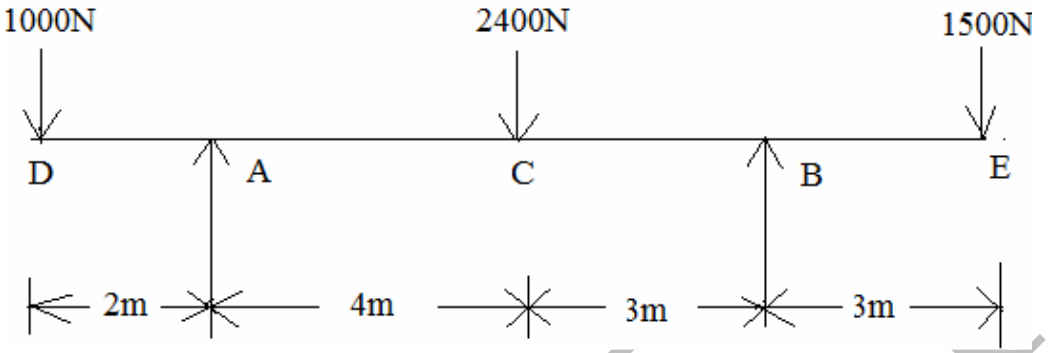
OR

b) A solid conical bar of circular section is suspended vertically as shown inFig.2. If the length of the bar is 'l' and the weight per unit volume of the material of the bar is 'w', determine the total elongation of the bar due to its own weight.



Section II

2a) Calculate the reactions at the supports A and B of the beam shown in Fig. Draw the B.M.D and S.F.D. Determine also the points of contra flexure within the span AB and show their positions on the bending moment diagram

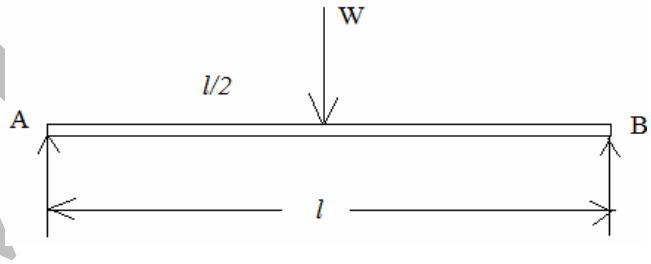


OR

b) A cantilever PQRS 7m long is fixed at P such that Pq= QR= 2m and RS=3m . It carries loads of 5,3 and 2kN at Q,R and S respectively in addition to UDL of 1kN/m run between P and Q and 2kN/m run between R and S .Draw SFD and BMD.

Section III

3a) A timber beam of rectangular section is simply supported at the ends and carries a point load at the center of a beam. The maximum bending stress is 12N/mm^2 and maximum shearing stress is 1 N/mm^2, find the ratio of the span to the depth as shown in fig.



OR

b) A cast iron beam section of T-section with a top flange 8cmX2cm thick, bottom flange 16cmX4cm thick and the web 20cm deep and 2cm thick. The beam is freely supported on a span of 5metres. If the tensile stress is not to exceed 20 MN/m^2, find the safe uniformly distributed load which the beam can carry. Find also the Maximum compressive stress.

Section IV

4a) A cylindrical shell is 3 m long, 1m internal diameter and 15mm thickness. Calculate the Maximum intensity of the shear stress and also the change in dimensions of the shell if it is subjected to an internal fluid pressure of 1.5N/mm^2.

OR

b) A steel shaft transmits 105kW at 160rpm. If the shaft is 100mmin diameter, find the torque on the shaft and the maximum shearing stress induced. Also find the twist of the shaft in a length of 6m, take C= 8X10^{4}N/mm^2

Section V

5a) In a shaft tranmitting power the shearing stress at the surface of the shaft is 60N/mm^2. In addition there is a bending moment producing a bending stress of 85N/mm^2 at the surface. Find the magnitude and the directions of the principal stresses. If the shaft diameter is 75mm find the eqivalent bending moment which acting alone on the shaft would produce a strain equal to the greater principal strain. Take poisso's ratio=0.286.

OR

b)A shaft section 100mm in diameter is subjected to a bending moment of 4000n-m and a torque of 6000 N-m. Find the maximum direct stress induced on the section, and specify the position of the plane on which it acts. Find also, what stress acting alone can produce the same maximum atrain. Take poisso's ratio = 0.25.

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

MECHANICS OF SOLIDS (R13)

MODEL PAPER – II

Max Marks: 70

Section I

1a) A bar of 30mm diameter is subjected to a pull of 60KN. The measured extension on a gauge length of 200mm is 0.09mm and the change in diameter is 0.0039mm. Calculate the Poisson's ratio and the values of the three moduli (E,G & K).

OR

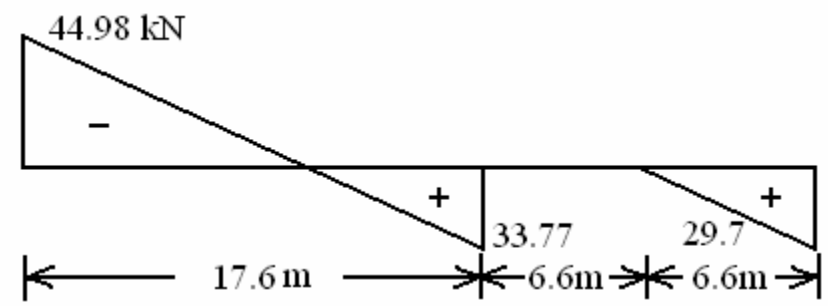
b) A steel bar is placed between two copper bars, each having the same area and length as steel bar at 20°C, At this stage , they are rigidly connected together at both the ends. When the temperature is raised to 320°C , the length of the bars increases by 1.5mm. Determine the original length and find stresses in the bars.

Take E_s=220GN/m^2 , E_c=110GN/m^2

α_s=0.000012 per°C and α_c=0.0000175 per°C

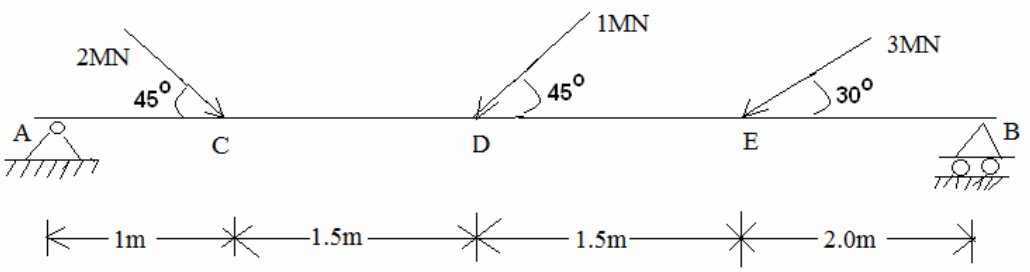
Section II

2a) The following Figure 2 indicates the Shear Force diagram. Develop the loading and Bending Moment diagram for the beam.



OR

b) Analyse the beam shown in Fig. Draw S.F.D, B.M.D and Thrust Diagram



Section III

3a) The shear force acting on a section of a beam is 100KN. The section of the beam is of T-shaped of dimensions 200 mm × 250 mm × 50 mm. The flange thickness and web thickness are 50 mm. Moment of inertia about the horizontal neutral axis is 1.134×10^{8} mm^{4}. Find the shear stress at the neutral axis and at the junction of the web and the flange.

OR

b) A cantilever of square section 200 mm × 200 mm, 2.0 m long, just fails in flexure when a load of 12KN is placed at its free end. A beam of the same material and having a rectangular cross-section 150 mm wide and 300 mm deep is simply supported over a span of 3.0 m.Calculate the minimum central concentrated load required to break the beam.

Section IV

4a) A bronze spherical shell is made of 1.5cm thick plate. It is subjected to an internal pressure of $1MN/m^2$. If the permissible stress in the bronze is $\%\%MN/m^2$, calculate the diameter of the spherical shell taking the efficiency as 80%.

OR

b) A solid shaft of 200mm diameter has the same cross-sectional area as that of hollow shaft of the same material with inside diameter 150mm. Find the ratio of power transmitted by the two shafts at the same speed.

Section V

5a) An I- beam with flanges of size 200mmX 20mm and a web of 600mm X 12 mm is subjected to a bending moment of 450kN-m and a shear force of 400kN at a section. Determine the magnitude of the bending stress and shear stress at a point 200mm above the neutral axis. Find also the principal stresses at this point.

OR

b) A horizontal steel bar of 40mm diameter solid section is 2.4m long and is rigidly held at both ends so that no angular rotation occurs either axially or circumferentially at the ends. If a bracket at the centre of the span supports a vertical load of 250N at a horizontal lever arm of 0.5m, what is the maximum tensile stress in the bar.

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

MECHANICS OF SOLIDS (R13)

MODEL PAPER – III

Max Marks: 70

Section I

1a) A prismatic member of length l and unit weight w is suspended freely from its end. Determine the elongation of the member under gravity.

OR

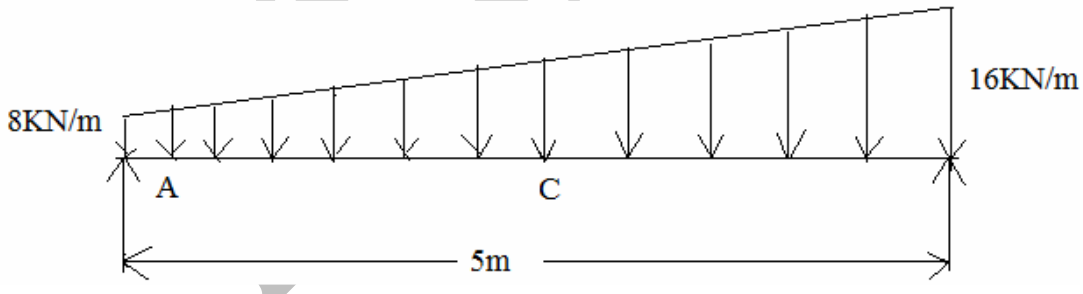
b) A steel tube 50mm in external diameter and 3.0mm thick encloses centrally a solid copper bar of 35mm diameter. The bar and the tube are rigidly connected together at the ends at a temperature of 20^0C.Find the stress in each metal when heated to 170^0C.Find the stress in each metal when heated to 170^0C .Also find the increase in length, if the original length of the assembly is 350mm.Coefficients of expansion for steel and copper are 1.08×10^{-5} per ^{0}C and 1.7×10^{-5} per ^{0}C respectively.
Take $E_s=2.0\times10^5$ N/mm^2, $E_c=1.0\times10^5$ N/mm^2.

Section II

2a) A Beam of length 6.0m is simply supported at the ends and carries a u.d.l of intensity 1.5KN/m run and three concentrated loads of 1KN, 2KN and 3KN acting at a distance of 1.5m, 3.0m and 4.5m respectively from left end. Draw the S.F.D and B.M.D and also determine the maximum bending moment.

OR

b) The intensity of loading on a simply supported beam of 5.0m span increases uniformly from 8KN/m at one end to 16KN/m at the other end as shown in Fig.1. Find the position and magnitude of the maximum bending moment. Also draw S.F.D and B.M.D.



Section III

3a) A circular beam of 100mm diameter is subjected to a shear force of 5KN. Calculate:
i) Average shear stress,
ii) Maximum shear stress, &
iii) Shear Stress at a distance of 40mm from N.A.

b) Derive an expression for the shear stress at any point in a circular section of a beam, which is subjected to a shear force 'F'.

OR

c) A beam consists of a symmetrical rolled steel joist. The beam is simply supported at its ends and carries a point load at the centre of the span. If the maximum stress due to bending is 140MPa, find the ratio of depth of the beam to span on order that the central deflection nay not exceed 1/480 of the span. Take E= 200GPa.

Section IV

4a) A boiler shell is to made of 15mm thick plate having a limiting tensile stress of 120MN/m^2. If the longitudinal and circumferential efficiencies are 70% and 30% respectively , determine what maximum diameter of the shell would be allowed for a maximum pressure of 2MN/m^2.

OR

b) A hollow shaft of diameter ratio 3/5 is required to transmit 450kW at 120 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m must not exceed 1°. Calculate the minimum external diameter of the shaft satisfying these conditions. Take the modulus of rigidity C= $8X10^4$ N/mm^2

Section V

5a)A simply supported beam of rectangular section is 200mm wide and 300mm deep.It supports a uniformly distributed load of 6 kN/m over an effective length of 4m. Calculate the magnitude and direction of the principal stresses at a point located 0.5m from the left support and 50mm above the neutral axis.

OR

b) At a certain point in a strained material the principal stresses are 100 N/mm^2 and 40N/mm^2 both tensile. Find the normal, tangential and resultant stresses across a plane through the point at 48° to the major principal plane, using Mohr's circle of stress.

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

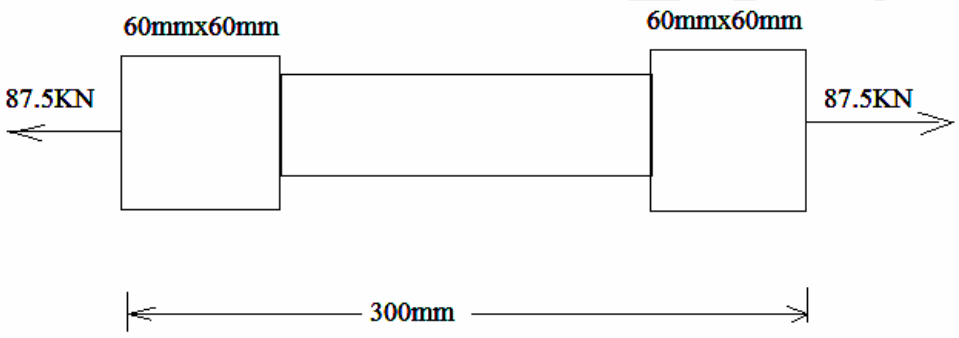
MECHANICS OF SOLIDS (R13)

MODEL PAPER – IV

Max Marks: 70

Section I

1a) A tie bar has enlarged ends of square section 60 mm × 60 mm as shown in Fig.1.If the middle portion of the bar is also of square section, find the size and length of the middle portion if the stress there is 140N/mm^2 and the total extension of the bar is 0.14mm. Take E= 2.0×10^5 N/mm^2.



OR

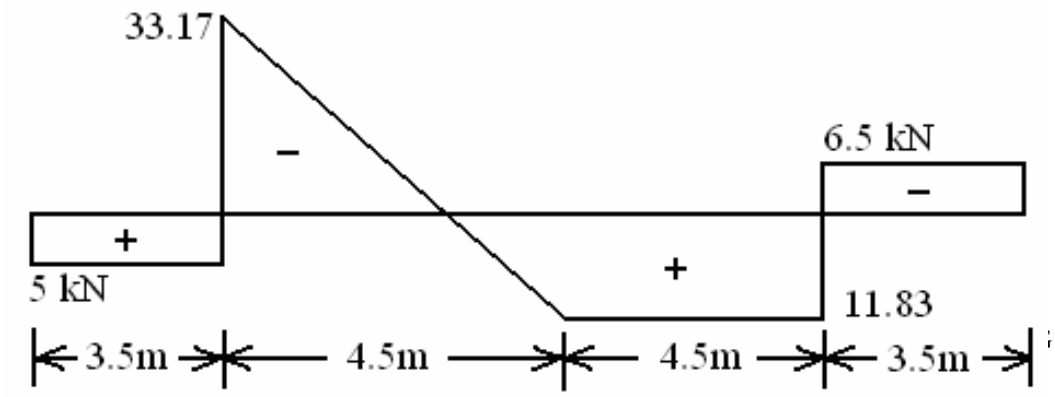
b)A steel rod 25m long is at a temperature of 20^{0}C. Find the free expansion of the rod when the temperature is raised to 65^{0}C. Find the temperature stress produced:

i) When the expansion of the rod is prevented and

ii) When the rod is allowed to expand by 6.0mm. Take α=12.0×10^{-6} per ^{0}C and E=2.0×10^5 N/mm^2.

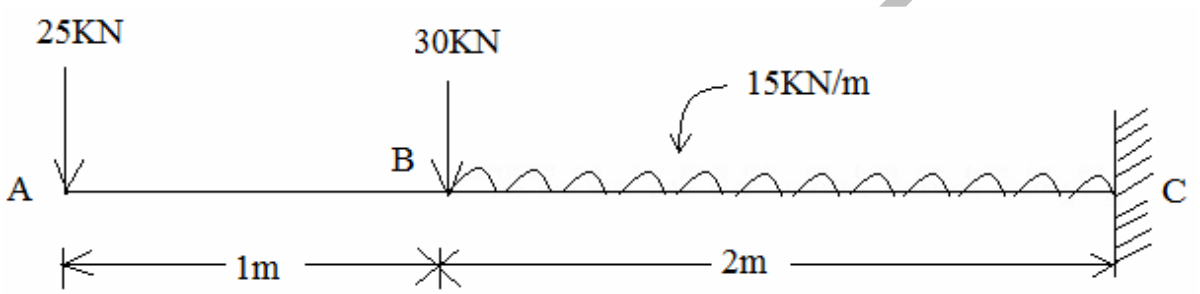
Section II

2a) The following Figure indicates the Shear Force diagram. Develop the loading and Bending Moment diagram for the beam.



OR

b) Draw SFD and BMD for the given loading diagram shown in fig.



Section III

3a) Two wooden planks 150mmX 50mm each are connected to form a T- section of a beam, If a moment of 3.4kN-m is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the stresses at the extream fibres of the cross section. Also calculate the total tensile force on the cross-section.

OR

b**)** An I-section, with rectangular ends, has the following dimensions: Flange- 15cmX 2cm and web: 30cm X1cm. Find the maximum shearing stress developed in the beam for a shearing force of 10kN.

Section IV

4a) A gunmetal tube of 50mm bore, wall thickness 1.25mm is closely wound externally by a steel wire 0.5mm diameter. Determine the tension under which the wire must be wound on the tube, if an internal radial pressure of 1.5MN/$m^2$is required before the tube is subjected to the tensile stress in the circumferential direction.
Take E (for tube) =102 GN/m^2, E(for wire) = 210GN/m^2 and poisson's ratio is 0.35.

OR

b) A hollow mild steel shaft having 100mm external diameter and 50mm internal diameter is subjected to a twisting moment of 8kNm and a bending moment of 2.5 kN/m. Calculate the principal stresses and find direct stress which acting alone, would produce the same.
(i) Max elastic strain energy
(ii)Max elastic shear strain energy, as that produced by the principal stresses acting together.

Section V

5a) A rectangular block of material is subjected to a tensile stress of 100 N/mm^2 on one plane and a tensile stress of 50N/mm^2 on a plane at right angles, together with shear stress of 60N/mm^2 on the same planes. Find i) The direction of the Principal Planes
ii) The magnitude of the Principal stresses
iii) The magnitude of the greatest shear stresses.

OR

b) Two planes AB and BC are at right angles carry shear stresses of intensity 17.5 N/mm^2 while these planes also carry a tensile stress of 70N/mm^2 and a compressive stress of 35N/mm^2 respectively. Determine the Principal planes and the principal stresses. Also determine the maximum shear stresses and planes on which it acts.

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
MECHANICS OF FLUIDS (R17)
MODEL PAPER – I
MAXIMUM MARKS: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 10M.

1. a. Two plates are placed at a distance of 0.15 mm apart. The lower plate is fixed while the upper plate having the surface area of 1.0 m^2 is pulled at 0.3 m/s. Find the force and the power required to maintain this speed, if the fluid separating them is having viscosity 1.5 poise.
   b. Derive an expression for total pressure and center of pressure for a vertically plane surface immersed in a liquid.
   OR
2. Explain the working of a Bourdon tube pressure gauge using a neat sketch.

3. a. A 40 cm diameter pipe, conveying water, branches into two pipes of diameter 30 cm and 20 cm respectively. If the average velocity in the 40 cm pipe is 3 m/s, find the discharge in this pipe and also determine the velocity in 20 cm pipe. The average velocity in 30 cm pipe is 2 m/s.
   b. The two velocity components are given in the following cases, find the third component such that they satisfy the continuity equation for steady, incompressible flow.
   i. $u = x^3 + y^2 + 2z^2 ; v = -x^2y - yz - xy$
   ii. $u = 2y^2, w = 2xyz$
   OR
4. The velocity vector in a flow field is given as $\boldsymbol{V} = 4x^3\boldsymbol{i} - 10x^2y\boldsymbol{j} + 2t\boldsymbol{k}$. Find the velocity and acceleration of a fluid particle at (2,1,3) at time t = 1.

5. a. A pipe line carrying oil of specific gravity 0.8 changes in diameter from 300 mm at a position A to 500mm at position B which is 5m higher level. If the pressures at A and B are 19.6 N/cm^2 and 14.9 N/cm^2 respectively for a discharge of 150 liters per sec. Find the loss of head and the direction of flow.
   b. What is impulse momentum equation?
   c. What are the uses of dimensional analysis? Explain in brief.
   OR
6. What is the principle of orifice meter? Derive the expression for discharge through an orifice meter.

7. The velocity profile in a laminar boundary layer is given by $\frac{u}{V\infty} = 2\left(\frac{y}{\delta}\right) - 2(\frac{y}{\delta})^3 + \left(\frac{y}{\delta}\right)^4$. Find the expressions for boundary layer thickness, shear intensity and drag force on one side of the plate.

OR

8. *A man weighing 90kgf descends to the ground from an airplane with the help of a parachute against the resistance of air. The velocity with which the parachute which is hemi – spherical in shape is 20 m/s downwards. Find the diameter of the parachute. Assume C_D = 0.5 and the density of air = 1.25 kg/m^3.*

9. *Derive the relation between shear stress and velocity for the laminar flow between two parallel plates while one plate is stationary and the other is moving with a uniform velocity.*

OR

10. *Using a neat sketch, show the hydraulic gradient line and energy gradient line for the flow through a pipe. What is the significance and applications of the same?*

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
MECHANICS OF FLUIDS (R17)
MODEL PAPER – II
MAXIMUM MARKS: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 10M.

1. a. Define the term Buoyancy. Explain using neat sketch, the conditions for equilibrium of a submerged body in fluid.
   b. Define Meta center and Meta centric height. Explain the analytical method for determining meta – centric height.
   OR
2. The opening in a dam is 3m wide and 2m high. A vertical sluice gate is used to cover the opening. On the upstream of the gate, the liquid of specific gravity 1.5 lies up to a height of 2m above the top of the gate, whereas on the down stream side, the water is available up to a height of top of the gate. Find the resultant force acting on the gate and the position of center of pressure. Assume that the gate is hinged at the bottom.

3. Derive the 3 – D continuity equation choosing a suitable flow model. Define all the symbols used while deriving it.
   OR
4. a. The 2 – D stream function for a flow is $\psi = 9 + 6x - 4y + 7xy$. Find the velocity potential.
   b. Diffentiate between Eulerian and Lagrangian methods of representing fluid flow.

5. a. A horizontal venturimeter with inlet and throat diameter 20 cm and 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through the venturimeter is 60 liters per sec. Find the reading of the oil – mercury differential manometer. Take C_d = 0.98
   b. A pipe of diameter 400mm carries water at a velocity of 25m/s. The pressure at the points A and B are given by 29.43 N/cm^2 and 22.563 N/cm^2 respectively, while the datum head at A and B are 28 m and 30 m respectively. Find the loss of head between A and B.
   OR
6. State Bernoulli's principle. Derive the Bernoulli's equation from Euler's equation of motion.

7. *Derive Von – Karman momentum integral equation.*
   OR
8. Explain boundary layer separation using a neat sketch and state the methods to avoid it.

9. a. *Determine the rate of flow of water through a pipe of diameter 10 cm and length 60 cm when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere.*

The height of the water in the tank from the center of the pipe is 5 cm. The pipe is horizontal and the friction factor is 0.01. Consider minor losses.

b. Determine the difference in the elevations in the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300 mm and length 400m. The rate of flow through the pipe is 300 liters per sec. Consider all the losses and take the value of f = 0.008.

OR

10. *Derive the relation between shear stress and velocity for the laminar flow between two stationary parallel plates.*

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
MECHANICS OF FLUIDS (R13)
MODEL PAPER – III
MAXIMUM MARKS: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 10M.

1. a. Derive an expression for Total Pressure and Center of pressure for an inclined plane surface submerged in a liquid.
   b. An inclined rectangular gate of width 5 m and depth 1.5m is installed to control the discharge of water as shown in fig. **(3.55/127 Bansal)**. The end A is hinged. Determine the force normal to the gate applied at B to open it.

   OR

2. a. Water is flowing through two different pipes to which an inverted differential manometer having an oil of sp. Gr 0.8 is connected. The pressure head in the pipe A is 2m of wate, find the pressure in the pipe B for the manometer readings as shown in fig. **(2.22/54 Bansal)**
   b. A 150mm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 151mm. Both the cylinders are of 250 mm height. The space between the cylinders is filled with a liquid of viscosity 10 poise. Determine the torque required to rotate the inner cylinder at 100 rpm.

3. a. What is a flow net? Describe the uses and limitations of a flow net.
   b. Check whether the flow defined by the stream function ψ = 2xy is irrotational. If so, determine the corresponding velocity potential.

   OR

4. For a steady incompressible flow, check the following values of u and v are possible or not.

a. $u = 4xy + y^2, v = 6xy + 3x$

b. $u = 2x^2 + y^2, v = -4xy$

5. a. What is meant by substantial derivative? Derive.
   b. Water is flowing through a pipe 5 cm diameter under a pressure of 29.43 N/cm^2 guage and with a mean velocity of 2m/s. Find the total head or total energy per unit weight of the water at a cross – section which is 5m above the datum line.

   OR

6. a. Differentiate between a model and a prototype.
   b. What are the conditions to be satisfied for both to be in dynamic similarity?
   c. What are the aims and objectives of model studies?

7. a. What is Magnus effect?

b. Find the diameter of the parachute with which a man of 80 kg descends to the ground form an airplane against the resistance of air with a velocity 25 m/s. Take $C_d = 0.5$ and density of air = $1.25 kg/m^3$.

OR

8. Define boundary layer thickness, displacement thickness, momentum thickness and energy thickness. Explain the significance of each.

9. *The rate of flow of water pumped into a pipe ABC which is 200m long is 20 liters per sec. the pipe is laid on an upward slope of 1 in 40. The length of the portion AB is 100m and its diameter is 100mm, while the length of the portion BC is also 100 m but its diameter is 200 mm. The change of diameter at B is sudden. The flow is from A to C. the pressure at A is 19.62N/cm^2 and end C is connected to a tank. Find the pressure at C and draw the hydraulic gradient and total energy line. Take f = 0.008.*

OR

10. *Three pipes of same length L, diameter D and friction factor f are connected in parallel. Determine the diameter of the pipe of length L and friction f which will carry the same discharge for the same head loss. Use Darcy's – Weishbach equation.*

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
MECHANICS OF FLUIDS (R17)
MODEL PAPER – IV
MAXIMUM MARKS: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 10M.

1. a. Explain the working of a U – tube and inverted U – tube manometer.

   b. Calculate the pressure and density of air at a height of 3000m above the sea level give the pressure and temperature at sea level as 10.413 N/cm^2 and 15^{0}C respectively. The temperature lapse rate is given as 0.0065^o K/m. The density of air at sea level is 1.285 kg/m^3.

   OR

2. a. Determine the Bulk modulus of elasticity of a liquid, if the pressure of the liquid is increased from 70 N/cm^2 to 130 N/cm^2. The volume of the liquid is decreased by 0.15 percent.

   b. The velocity distribution for flow over a flat plate is given by $u = \frac{3}{2}y - y^{3/2}$, where *u* is the point velocity in m/s at a distance *y* meter above the plate. Determine the shear stress at y = 9 cm. Assume dynamic viscosity as 8 poise.

3. Define and derive the expressions for local and convective accelerations.

   OR

4. a. What are the types of displacement that a fluid particle undergoes while in motion of a fluid? Explain using neat sketches.

   b. Water flows through a pipe AB 1.2m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. The branch CD is 0.8 m diameter and carries one – third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in CD and the diameter of CE.

5. 250 liters of water is flowing in a pipe having diameter 300 mm. If the pipe is bent by 135^0, find the magnitude and direction of the resultant force on the bend. The pressure of water flowing is 400 kN/m^2.

   OR

6. a. Explain the working of a capillary tube viscometer.

   b. Explain the working of a concentric – cylinder viscometer.

7. *Using neat sketches, explain the development of lift over a circular cylinder.*

   OR

8. For the velocity profile for laminar boundary layer $\frac{u}{V\infty} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$. Determine the boundary layer thickness, shear stress, drag force.

9. *a. Three pipes of length 800m, 500m and 400m and of diameters of 500mm, 400mm and 300mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700m. Find the diameter of the single pipe.*

   b. What is a siphon? What are its advantages?

   OR

10. *An oil of viscosity 0.1 N/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50mm and the length of 300m. The rate of flow of fluid through the pipe is 3.5 liters per second. Find the pressure drop in a length of 30 m and also the shear stress at the pipe wall.*

II B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
MECHANICS OF FLUIDS (R13)
MODEL PAPER – V
MAXIMUM MARKS: 70

i. Answer only one question among the two questions in choice.
ii. Each question answer (irrespective of the bits) carries 10M.

1. a. Define vapor pressure and its effects.
   b. State and prove Hydrostatic law.
   c. Explain the variation of viscosity of fluids with temperature.
   OR
2. a. A shaft of diameter 100 mm is rotating inside a journal bearing of diameter 102mm at a pace of 360 rpm. The space between the shaft and the bearing is filled with a lubricating oil of viscosity 5 poise. The length of the bearing is 200mm. Find the power absorbed in the lubricating oil.
   b. A cubical tank has sides of 1.5m. It contains water for the lower 0.6m depth. The upper remaining part is filled with oil of specific gravity 0.9. Calculate for one vertical side of the tank: i. total pressure and (ii) position of center of pressure.

3. A flow field is given by $\boldsymbol{V} = x^2y\boldsymbol{i} + y^2z\boldsymbol{j} - (2xyz + yz^2)\boldsymbol{k}$. Prove that it is a possible case of steady incompressible flow. Calculate the velocity and acceleration at point (2,1,3).
   OR
4. a. Differentiate rotational and irrotational flows. Define vorticity. What are the properties of velocity potential function?
   b. The velocity components in a 2D flow are given by $u = \frac{y^3}{3} + 2x - x^2y$ and $= xy^2 - 2y - \frac{x^3}{3}$. Show that these components represent a possible case of an irrotational flow.

5. a. Explain the working of a pitot – static tube and mention its purpose.
   b. A pitot – tube is inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of Hg vacuum. The stagnation pressure at the center of the pipe, recorded by the tube is 0.981 N/cm^2. Calculate the rate of flow of water through the pipe, if the mean velocity of the flow is 0.85 times the central velocity. Take C_v = 0.98.
   OR
6. A nozzle of diameter 20 mm is fitted into a pipe of 40 mm. Find the force exerted by the nozzle on the water which is flowing through the pipe at the rate of 1.2 m^3/minute.

7. *Derive the expressions for drag and lift on an arbitrary shaped body place in a uniform field.* ***OR***

8. *The velocity distribution in the boundary layer is given by* $\frac{u}{V\infty} = \frac{y}{\delta}$. *Show that the displacement thickness is* δ *times the momentum thickness.*

9. *a. Determine the pressure gradient, the shear stress at the surface of the plates and the discharge per meter with for the laminar flow of oil having maximum velocity of 2m/s between tow horizontal parallel fixed plates which are 100 mm apart. Given* $\mu = 2.4525$ *N-s/m*^{2}.

   For the problem above, sketch the shear stress and velocity profile.

   OR

10. *a. Define equivalent pipe using necessary illustrations for pipes in series and parallel.*

    b. An old water supply distribution pipe of 250 mm diameter of a city is to be replaced by two parallel pipes of smaller equal diameter having equal lengths and identical friction factor values. Find out the new diameter required.

Code No: R15A0362

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Regular/Supplementary Examinations, November 2017

Mechanics of Fluids

(AE)

Roll No										

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B

Part A is compulsory which carriers 25 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

PART – A (25 Marks)

1. (a) Define center of pressure. What are the cases for submerged surfaces to determine the total pressure fore and center of pressure? 2 M

(b) Define the terms gauge, vacuum and absolute pressure. A fresh water lake has a maximum depth of 60 m and the mean atmospheric pressure is 91 kPa. Estimate the absolute pressure in kPa at this maximum depth. 3 M

(c) Differentiate between a stream line and a streak line? 2 M

(d) The velocity component in a 2-D flow field for an incompressible fluid are expressed as

$$u = \frac{y^3}{3} + 2x - x^2y\,;\; v = xy^2 - \frac{x^3}{3} - 2y$$

Obtain an expression for stream function ψ. 3 M

(e) What are the forces acting on fluid in motion? 3 M

(f) Explain the concept of flow through nozzles? 2 M

(g) Define laminar boundary layer and turbulent boundary layer? 2 M

(h) Define momentum thickness and energy thickness with formula? 3 M

(i) Name four points how repeating variables are selected. 2 M

(j) A flat plate of size 2x3 m is submerged in water flowing with velocity of 6 m/s. Find drag and lift if $C_D = 0.04$ and $C_L = 0.2$. 3 M

PART – B (50 Marks)

SECTION – I

2. a) Explain the center of buoyance and metacenter. 4 M

b) Explain briefly i) Newton's law of viscosity

ii) Newtonian and Non Newtonian fluids

iii) Surface tension 6 M

(OR)

3. Explain and differentiate the types of manometers?

SECTION – II

4. a) Prove that velocity potential exists only for irrotational flows of fluids? 5 M
   b) Differentiate between laminar, transient and turbulent flows? 5 M

(OR)

5. a) Derive an expression for 2-D continuity equation for compressible and incompressible flows in Cartesian co-ordinates? 5 M
   b) Write a short note on classification of fluids? 5 M

SECTION – III

6. a) Derive Euler equation and from that Bernoulli's equation? 6 M
   b) Explain the working principle of pitot tube? Derive the equation for measuring the velocity of flow passing through pipe using pitot tube? 4 M

(OR)

7. a) A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200 mm at a position A to 500 mm diameter a position B which is 4 m at high level. If pressure at position A and B are 1.01 bar and 0.6 bar respectively and the discharge is 200 liters/second, determine the loss of head and direction of flow? 6 M
   b) State the reasons for difference in the C_d value in venture meter and orifice meter. 4 M

SECTION – IV

8. a) Explain the boundary layer growth and its characteristics along the thin flat plate with neat diagram? 6 M
   b) For a laminar flow of oil having a dynamic viscosity $\mu = 1.76$ Pa. s in a 0.3 diameter pipe the velocity distribution is parabolic with a maximum point velocity of 3 m/s at a center of pipe. Calculate shear stresses in pipe? 4 M

(OR)

9. Discuss the methods of controlling the separation of boundary layer?

SECTION – V

10. a) How do you ensure that model and prototype are similarly developed. 5 M
    b) Explain the dimensionless numbers. 5 M

(OR)

11. Derive lift and drag forces acting on a stationary body submerged in a moving fluid.

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Code No: R15A0362

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B. Tech I Semester Supplementary Examinations, May 2018

Mechanics of Fluids

(AE)

Roll No										

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B

Part A is compulsory which carriers 25 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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PART – A (25 Marks)

12. (a) Differentiate between compressible and incompressible fluid. 2 M

(b) Define ideal fluid and State Newton's law of viscosity . 3 M

(c) Define the rotational and irrotational flow? Write down the condition for irrotational flow? 2 M

(d) Calculate the unknown velocity component so that they satisfy the continuity equitation 3 M

$$u = (2x^2 + 2xy); w = (z^3 - 4xz - 2yz); v = ?$$

(e) Write the assumptions involved in deriving the Bernoulli's equation. 2 M

(f) What are the basic principles used in the analysis of problems of fluid in motion? Write a short note on them. 3 M

(g) Write down the difference between laminar boundary layer and laminar sub-layer? 2 M

(h) Draw the velocity profile in adverse pressure gradient conditions for the flow over a flat plate? Show the conditions involved. 3 M

(i) Define drag and lift. 2 M

(j) What is similitude and write the types of similarities. 3 M

PART – B (50 Marks)

SECTION – I

13. a) Derive an expression for total pressure force and center of pressure for vertical plane surface submerged in liquid. 5 M

b) Determine the total pressure acting on a circular plate of diameter 1.5 m which is placed in water in such a way that center of the plate is 3 m below the free surface of the water. Also, find the position of center of pressure. 5 M

(OR)

14. a) State and prove Pascal's law. 5 M

b) Differentiate between kinematic and dynamic viscosity. 5 M

SECTION – II

15. a) Prove that stream lines and equi-potential lines are perpendicular to each other. 5 M

b) Define and distinguish between laminar flow and turbulent flow, uniform flow and non-uniform flow? 5 M

(OR)

16. a) A stream function follow the law $\psi = 4x^2 - 4y$

Obtain the velocity potential function. 7 M

b) What do you understand by rotational and vortex flow? 3 M

SECTION – III

17. a) Differentiate between total, local and convective accelerations with one example. 5 M

b) Explain what do you understand by the terms major and minor energy losses in pipe? 5 M

(OR)

18. a) Explain any two applications of Bernoulli's principle? 4 M

b) Explain the working of pitot tube. Write the application of pitot tube in aerospace Industry. 6 M

SECTION – IV

19. a) Draw a neat sketch to explain boundary layer growth over a flat plate at zero angle of attack. 5 M

b) Explain the phenomenon of boundary layer separation? 5 M

(OR)

20. If $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^2$, find shear stress, boundary layer thickness and drag coefficient from the fundamental equations of the boundary layer? 10M

SECTION – V

21. a) Explain the forces developed by moving fluid on stationary body. 5 M

b) A vehicle projected with an area of 6.5 square meter moving at 70 km/hour has a total resistance of 2000 N. of this 25 per cent is due to rolling friction and 5 per cent due to surface

friction. The remaining is due to form drag. Calculate the co-efficient of form drag with a density of 1.25 kg/m^3. 5 M

(OR)

22. a) State Buckingham's π-theorem with an example. 5 M

b) Briefly explain why dimensional analysis is required. 5 M

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