FLIGHT VEHICLE DESIGN (R15A2114)

MODEL PAPERS

III B. Tech II Semester

(2017-2018)

Prepared By

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MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

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Code No: R15A2114 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B. Tech II Semester Regular Examinations, April/May 2018

Flight Vehicle Design

(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)**

1. (a) What are the differences between passenger and cargo airplanes from the point of view of design requirements? [2M]
   (b) What are the pros and cons of high wing arrangement? [3M]
   (c) What do you mean by lofting? [2M]
   (d) Explain about flat-wrap fuselage lofting. [3M]
   (e) Draw the combined v-n diagram for estimation of gust loads. [2M]
   (f) Define gear load factor [3M]
   (g) Explain about BFL(Balanced field length). [2M]
   (h) Explain the reason why RDT&E and Production costs are combined together? [3M]
   (i) What are the requirements to design VTOL? [2M]
   (j) Explain the difference between delta and double delta wing. [3M]

PART – B **(50 Marks)**

SECTION – I

2. a) Explain the phases of aircraft design? [5M]
   b) How design take-off gross weight is calculated? [5M]

(OR)

3. Write a short note on following
   a) Different types of tail arrangements. [5M]
   b) Effect of tail arrangement on spin recovery of an aircraft with neat sketch. [5M]

SECTION – II

4. Explain in detail about wetted area, volume distribution plots with neat sketches and graphs. [10M]

(OR)

5. a) Explain Radar cross section. [5M]

b) Briefly explain control surface sizing. [5M]

SECTION – III

6. Explain in detail about aircraft subsystems with neat sketches. [10M]

(OR)

7. What are the high lift devices and effects of these high lift devices upon the lift curve of a wing? [10M]

SECTION – IV

8. Write in detail about takeoff analysis with neat sketch. [10M]

(OR)

9. Explain in detail about on elements of life cycle cost. [10M]

SECTION – V

10. What are the fundamental problems involved in VTOL design? [10M]

(OR)

11. Explain about the design of Boeing B-47 & 707. [10M]

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III B.TECH II SEMESTER – AERONAUTICAL ENGINEERING
(R15A2116) FLIGHT VEHICLE DESIGN

MODEL PAPER – I
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

i. All questions in this section are compulsory
ii. Answer in TWO to FOUR sentences.

1) Explain about the design wheel with sketch (2M)
2) Define take-off weight build up (3M)
3) What is rubber engine sizing (3M)
4) Define conic lofting (2M)
5) Define "tip back angle" (3M)
6) Explain about the selection of materials for an aircraft (2 M)
7) Explain about trade studies (3 M)
8) Define balanced field length (2 M)
9) Explain VTOL terminology (3M)
10) Define the phases of aircraft design using flow diagram (2M)

PART B **Max Marks: 50**

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

11) Explain Thrust Matching & also explain about the Thrust –To Weight Ratio and Wing Loading

OR

12) Explain tail geometry and arrangements in detail with requires sketches

13) Write the equation for rubber engine sizing

OR

14) What is Radar Detect ability explain in detail with fig

15) Explain in detail about the shock absorbers

OR

16) Explain aircraft subsystems in detail with neat sketches

17) Explain aircraft operating envelope

OR

18) What do you understand by RDT&E and production costs explain

19) Explain about VTOL Aircraft design

OR

20) Explain in detail about the design of the DC- 1

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(R15A2116) FLIGHT VEHICLE DESIGN

MODEL PAPER – II
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

i. All questions in this section are compulsory
ii. Answer in TWO to FOUR sentences.

1) Explain specific fuel consumption (2M)
2) Define range (3M)
3) Explain geometry sizing (3M)
4) Explain about flat-wrap fuselage lofting (2M)
5) Define wing loads (3M)
6) Define oleo pneumatic shock strut (2M)
7) Define RDT&E (3M)
8) Define ground roll in landing analysis (2M)
9) Define delta wing with neat sketch (2M)
10) Draw neat sketches of suck down and fountain lift (3M)

PART B **Max Marks: 50**

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

11) Explain in detail the conceptual design phase in aircraft design

OR

12) Explain mission profiles with a neat sketch and also explain mission segment weight fractions for simple cruise

13) Explain in detail about the airfoil geometry with req sketches

OR

14) How wetted area and volume determination is estimated

15) Explain in detail about the structural considerations in special considerations in configuration layout with neat figures

OR

16) Explain about the design configuration of crew station, passenger compartment, and cargo provisions

17) Explain landing analysis in detail with a neat sketches and equations

OR

18) Explain elements of lift – cycle cost and cost – estimating methods

19) Explain in detail about design of the DC- 2 aircraft

OR

20) Explain about VTOL jet – propulsion options

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(R15A2116) FLIGHT VEHICLE DESIGN

MODEL PAPER – III
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

i. All questions in this section are compulsory
ii. Answer in TWO to FOUR sentences.

1) Define drag polar (2M)
2) Write about the subsonic lift-curve slope with sketch (3M)
3) Define leakage and protuberance drag (3M)
4) Define Oswald span efficiency factor (2M)
5) Define young's modulus (2M)
6) Explain about the trim condition (3M)
7) Define level flight (2M)
8) Define total take –off distance (3M)
9) Explain uninhabited air vehicles (3M)
10) Define cut-off forward swept (2M)

PART B **Max Marks: 50**

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

11) Explain about the overview of the design process and phases of aircraft design

OR

12) Explain about the airfoil & geometry selection

13) Explain in detail about conic lofting

OR

14) Explain about vulnerability considerations , crashworthiness considerations and producibility considerations

15) Explain about the air loads due to maneuver loads ,gust loads, air loads due to control deflection

OR

16) Compare the drag polar of a symmetric airfoils and a cambered airfoils

17) Explain refined baseline design and report of specifications

OR

18) Explain about effects of wind on aircraft performance

19) Explain about the hypersonic vehicles

OR

20) Explain about SR -71 Black bird Northrop – Grumman

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(R15A2116) FLIGHT VEHICLE DESIGN

MODEL PAPER – IV
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

i. All questions in this section are compulsory
ii. Answer in TWO to FOUR sentences.

1) Explain what is RDT&E and production costs (3M)
2) Define stability (2M)
3) Define static lateral directional stability and trim (3M)
4) Explain in short about the carpet plot (2M)
5) Define load factor (2M)
6) Define aerodynamic center (3M)
7) Define propulsion efficiency (3M)
8) Explain in short about gross thrust and net thrust (2M)
9) Explain in short about the aerodynamic forces (3M)
10) Briefly explain about aerodynamic coefficients with fig (2M)

PART B **Max Marks: 50**

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

11) Explain what is Design and Design Wheel?

OR

12) Derive the relationship between the thrust – to – weight ratio and wing loading of an aircraft in climb

13) Explain about conic shape parameter

OR

14) What are the factors involved in deciding the location of the wing with respect to the fuselage? Explain in detail
15) What are the functions of a landing gear system?

OR

16) Describe the maneuver loads acting on an aircraft?

17) Write short notes on (a) Elements of life cycle cost, (b) cost analysis

OR

18) Explain in detail about the Measures of merit?

19) Explain about Boeing B-47 aircraft.

OR

20) Explain in detail about VTOL propulsion considerations

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MODEL PAPER – V
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

i. All questions in this section are compulsory
ii. Answer in TWO to FOUR sentences.

1) Explain the difference between the jet engine locations at chin and side with neat fig (3M)
2) Draw the neat figures of typical mission profiles for sizing (2M)
3) Define design take –off gross weight (3M)
4) Explain about airfoil geometry with a neat fig (2M)
5) Define wing dihedral, wing incidence angle ,taper ratio (3M)
6) Explain about maneuver (2M)
7) Explain fuel & oil costs (3M)
8) Write a short notes on cost estimating method (2M)
9) Write a short notes on Boeing B- 47 (3M)
10) Write about hypersonic vehicles ` (2M)

PART B **Max Marks: 50**

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

11) (a)Explain about take off – weight calculation (b)aircraft conceptual design process

OR

12) Explain about wing geometry and wing vertical location with neat sketches

13) Explain in detail about s(a) ears – Haack volume distribution (b) infrared detect ability

OR

14) Explain in detail about control surface sizing

15) Explain about landing gear arrangements

16) Explain in detail about aerodynamic considerations in configuration layout and crashworthiness considerations

17) Explain takeoff and landing analysis with neat sketches

OR

18) Explain about improved conceptual sizing methods and sizing matrix and carpet plots

19) Explain in detail about DC – 3 aircraft

OR

20) Explain hypersonic vehicles , delta and double delta wings

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III BTech II Semester - Air Transportation system

MODEL PAPER I

PART A

ANSWER ALL THE QUESTIONS **25 M**

1. Write about the history of Aviation evolution in the era of 1960. 2M
2. Focus on Development growth in the Aircraft Transportation 2M
3. Define Oligopolistic. 2M
4. Define the following : Industry , Transportation systems 2M
5. Write about the Economic growth in a country. 2M
6. What do you mean by Passenger Load Factor 3M
7. Describe the Aviation Industry Characteristics 3M
8. Write about Economic impact types in Air Transportation Systems 3M
9. What are the characteristics of Oligopolistic Industries 3M
10. What are effects that got improved after world war- II 3M

PART B

ANSWER FIVE QUESTIONS **5X10=50M**

1. Explain about the evolution for the Aircraft Systems.

or

2. Explain the Economic Characteristics.
3. Explain the Significance of Airline Passenger Load Factors.

or

4. Explain the Significance of Economic Impact.
5. Explain the Development, growth and challenges of ATS

or

6. Explain the Airlines as Oligopolistic.
7. Explain the Airline Industry structure in the 1960-1980's.

or

8. Explain the Economic growth in the Air Transportation

9. Explain the Economic impact- types and causes in the airlines

or

10. Explain the Aerospace Industry as a common term

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY
III BTech II Semester - Air Transportation system
MODEL PAPER II

PART A

ANSWER ALL THE QUESTIONS **25 M**

1. What do you mean by Physical issues 2M
2. Define the following the term Demandforecasting 2M
3. Define the following FAA,ICAO ,DGCA 2M
4. Write about the types of risk assessments 2M
5. Write about the functions of FAA 2M
6. Write about the functions of DGCA 3M
7. List out the functions of ICAO 3M
8. Write about the functions of IATA 3M
9. Write about the security regulation types 3M
10. Write about Reliability of forecasts 3M

PART B

ANSWER FIVE QUESTIONS **5X10=50M**

1. Explain the formation of International Air Law

or

2. Explain the formation and responsibilities of regulatory bodies like ICAO,IATA,DGCA and FAA
3. FEDERAL AVIATION ADMINISTRATION (FAA) is the one of the national authority what are the main functions of the FAA ,and how can you support your answer as it's very important to fly with these certificates in every national policies,Explain with FAA administration chart

Or

4. The International Civil Aviation Organization (ICAO)) is the one of the national authority what are the main functions of the ICAO ,explain with flow chart support your answer it's compulsory required license to fly different nations.
5. Give a brief about ICAO Future Air Navigation Systems (FANS) and its advantages and disadvantages when compared to existing systems

Or

6. The International Air Transport Association (IATA) is an international industry trade group of airlines write about its functions and regulations
7. Write about the risk assessment in the airport; support your answer whether it is compulsory for every airport.

or

8. Write the security regulation types in the airport and aviation field for traveling of passenger in different countries
9. Write the functions of ICAO and its certifications

or

10. Give a brief notes about ICAO Future Air Navigation Systems (FANS) and its advantages and disadvantages when compared to existing systems.

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III BTech II Semester - Air Transportation system

MODEL PAPER III

PART A

ANSWER ALL THE QUESTIONS **25 M**

1. Explain about the about the DME with the help of neat sketch..
   2M
2. Discussabout the SSR with the help of neat sketch 2M
3. Explain about the NAVIGATION with the help of neat sketch
   2M
4. What do you mean by the ACARS and explain with the help of neat sketch.
   2M
5. What do you mean by the GPWE and explain with the help of neat sketch 2M
6. What do you mean by TCAS and explain with the help of neat sketch 3M
7. What do you mean by EFIS and explain with the help of neat sketch 3M
8. What do you mean by AFCS and explain with the help of neat sketch 3M
9. What do you mean by VHF and explain with the help of neat sketch 3M
10. What do you mean by the PMS and explain with the help of neat sketch 3M

PART B

ANSWER FIVE QUESTIONS **5X10=50M**

1. Explain deferent types of the frequencies used in the navigation field with ranges in hedges

   or

2. Explain the process of Secondary surveillance radar (SSR) in the aviation signalling process explain with
3. Explain Distance measuring equipment (DME)process for the aviation system with neat figure and support your answer it's compulsory in the pilot cabin Aircraft Communications Addressing and Reporting System (ACARS) is the navigation system used from satellites for navigation explain the process of ACARS in detail with figure

   or

4. Explain Distance measuring equipment (DME)process for the aviation system with neat figure and support your answer it's compulsory in the pilot cabin Aircraft Communications Addressing and Reporting System (ACARS) is the navigation system used from satellites for navigation explain the process of ACARS in detail with figure
5. Aircraft Communications Addressing and Reporting System (ACARS) is the navigation system used from satellites for navigation explain the process of ACARS in detail with figure

   or

6. Traffic collision avoidance system(TCAS) is important in safe journey explain process with figures

7. Write a short notes on:
   a) Passenger Load factor b) Unique economic characteristics of air transportation systems.

or

11. Instrument landing system (ILS) is for the safety landing system explain the process with neat sketch
12. VHF omni-directional radio range (VOR) is the signals explain with diagrams and write applications of any four

Or

13. Navigation has the process of locating points and positions in the earth this is done by satiates explain the process of navigation

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III BTech II Semester - Air Transportation system

MODEL PAPER IV

PART A

ANSWER ALL THE QUESTIONS **25 M**

1. What do you mean by air fleet utilization 2M
2. What do you mean by Indirect operating costs 3M
3. What do you mean by direct operating costs 2M
4. What do you mean by Computerized reservation system 2M
5. What is the meaning of run way capacity 2M
6. Explain about run way characteristics of an airport 2M
7. What is the meaning of apron 3M
8. What do you mean by passenger terminals 3M
9. What do you mean by monitoring 3M
10. What do you mean by manoeuvring area, airfield lightening 3M

PART B

ANSWER FIVE QUESTIONS

[5X10=50M]

1. Define the runway length according to the length it has been categorized four types what are they explain in detail.

or

2. What is the importance of the safe guard in the airport explain in detail with figures
3. Passengers terminals plays an important role in the airport environment write the terminal entrance role in the airport and security process

or

4. How did the computer reservation systems revolutionize the profits out of the industry?.
5. Explain the need for the Manoeuvring area airfield lighting, in the airport

or

6. Explain the indirect cost in the aviation budgets for the airline growth and it’s development.
7. Explain the direct cost in the aviation budgets for the airline growth and it’s development.

or

8. What is mean by apron are in the airport explain in detail.
9. What are the different approaches to meet the airport construction successfully by taking issues explain in detail?

or

10. Explain the ticketing process growth in the last few years with neat figures

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III BTech II Semester - Air Transportation system

MODEL PAPER V

PART A

ANSWER ALL THE QUESTIONS **25 M**

1. Explain the Categories of airspace 2M
2. What is meaning of demand and delay 2M
3. What do you mean by radar assistance 2M
4. What do you mean by service providers 2M
5. What do you mean by CAPACITY 2M
6. What is the purpose of airspace sectors 2M
7. Write about CRS 2M
8. What is the purpose of Air-navigation service 3M
9. Explain the purpose of ATC SYSTEMS 3M
10. What do you mean by FANS 3M

PART B

ANSWER FIVE QUESTIONS **5X10=50M**

1. The Future Air Navigation System is the modern approach for the navigation explains in detail for this type of approaches in future and what are they?

(or)

2. a) Describe the characteristics of a modern airport. b) Are they economically viable?
3. Distinguish efficiency and effectiveness of an aircraft balanced by an airline? Explain.

or

4. Explain a) State-of-art ATC b) Separation in air c) Role of radar at the airport.
5. Broadly explain various communication systems used in air transport system

or

6. Define passenger load factor. Explain its role in airline industry
7. Is there a scope for starting a new airline company in India now? Extend your arguments

or

8. How are range, payload and fuel efficiency balanced? What are the roles played by the speed and cruisealtitude of aircraft in the economics of an airliner? Explain
9. What is the role of human factors in the safety of aviation? Discuss.

or

10. Explain in brief a)Runway characteristics b) Runway capacity.

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SUB: GREEN ENERGY SYSTEMS

MODEL QUESTION PAPER-I

III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. Write a note on total solar energy received in India.
2. Define solarinsolation
3. Define solar altitude angle
4. What are the advantages, and limitations of renewable energy sources
5. Explain briefly the different types of solar energy measuring instruments
6. Distinguish between diffuse radiation and beam radiation
7. Describe about solar geometry
8. What are conventional sources of energy
9. Explain the importance of solar energy in the present day energy crisis?
10. Explain solar azimuth angle and Zenith angle

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1. Write the important differences between renewable and nonrenewable source

(OR)

2. Define solar constant
3. Explain and derive expression for beam and diffuse radiation

(OR)

4. What are the reasons for variation in the amount of solar energy reaching earth surface.
5. Explain why it is necessary to develop non-conventional method of generating electrical energy

(OR)

6. Explain in detail the different types of solar energy measuring instruments
7. Write short note about the suns declination and hour angle

(OR)

8. Explain the working of a Pyrehliometer
9. Write short note about sunshine recorder

(OR)

10. Explain the working of a Pyranometer

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SUB: GREEN ENERGY SYSTEMS

MODEL QUESTION PAPER-II

III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. Explain the different types of solar energy storage systems
2. What is a solar pond?
3. Explain in brief about the applications of solar energy
4. Explain solar water heating
5. Explain in detail solar space cooling
6. What are the different applications of solar PV system in rural India plot
7. What is the principle of solar photovoltaic power generation?
8. Explain the equivalent circuit for solar PVpanel
9. Explain forced circulation solar water heater
10. Explain in brief about passive heating systems

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1. Explain the principle of conversion of solar energy into heat

(OR)

2. Describe the classification of solar energy collectors
3. What is flat plate collector? explain its operation

(OR)

4. Explain the advantages of flat plate collectors
5. Explain the advantages of concentrating collectors

(OR)

6. Explain the advantages of concentrating collectors over flat plate collectors
7. Explain the principle of operation of Fresnel lens collector

(OR)

8. Explain Compound Parabolic Concentrators
9. Explain the performance analysis of Cylindrical Parabolic Concentrator

(OR)

10. Explain the different methods of sun tracking

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SUB: GREEN ENERGY SYSTEMS

MODEL QUESTION PAPER-III

III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. What are the main components of a flat plate solar collector, explain the function of each
2. Describe the classification of solar energy collectors
3. What is flat plate collector? explain its operation
4. Explain the different types of line focusing type concentrating type collectors
5. What are the applications of solar air heaters
6. Explain the different types of point focusing type concentrating type collectors
7. Explain non focusing type concentrating collectors
8. Explain central receiver tower
9. Explain Compound Parabolic Concentrator(CPC)
10. Explain the effects of various parameters affecting the performance of collector?

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1.Explain mechanical solar energy storage systems

(OR)

2.What are the applications of solar ponds

3.Explain PV effect

(OR)

4.Explain in detail solar Space heating

5.Explain in detail solar distillation and drying

(OR)

6.With the help of a neat sketch describe a solar heating system using water heating solar collectors. What are the advantages and disadvantages of this method?

7.What are the advantages and disadvantages of PV solar energy conversion system

(OR)

8.Explain with a neat sketch the working principle of standalone and grid Connected solar system.

9.Describe the working of a solar power plant

(OR)

10.Compare solar PV system with solar thermal system

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SUB: GREEN ENERGY SYSTEMS

MODEL QUESTION PAPER-IV

III YR II SEMESTER

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

PART A Max Marks: 25

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. Mention two important wind turbine generator installations in India.
2. What is the type of generator used in wind powerplant?
3. How the wind mills are classified
4. What are the disadvantages of wind power?
5. What is meant by pitch angle?
6. Explain vertical wind mills with neat sketch
7. Constant speed constant frequency WTG unit
8. Variable speed constant frequency WTG system
9. Nearly constant speed constant frequencysystem
10. Explain the mechanism of production of local winds

PART B Max Marks: 50

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1. Write and explain wind power equation

(OR)

2. Define Tip speed ratio.
3. What are the advantages of wind power?

(OR)

4. Define Vertical Axis Wind Turbine(VAWT).
5. Explain Horizontal axis wind mills with neat sketch

(OR)

6. What is meant by pitch control and Yaw control
7. Constant speed constant frequency WTG unit.

(OR)

8. Nearly constant speed constant frequency system
9. What is the principle used in the measurement of speed of the wind?

(OR)

10. Explain the main applications of wind energy

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SUB: GREEN ENERGY SYSTEMS

MODEL QUESTION PAPER-V

III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. What are the constituents of biogas
2. Mention some organic materials used in bio-mass plant.
3. What are the factors affecting biogas generation
4. What is meant by liquefaction?
5. What are wet processes used for producing biogas
6. Explain the classification of biogas plants
7. Explain Deenbandhu type plant
8. Explain the utilization of biogas plant
9. Explain dry processes
10. Explain continuous and batch processes

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1 What is the difference between Bio mass and biogas

(OR)

2 Explain about dry and wet fermentation process

3 Explain pyrolysis

(OR)

4 Explain the classification of biogas plants

5 Explain Chinese Type plants

(OR)

6 Explain floating drum type biogas plants

7 Explain the operation of IC engine with biogas and discuss their performance characteristics

(OR)

8 What are the classifications of geo thermal sources?

9 What are the various factors affecting bio digestion of a gas?

(OR)

10 Explain KVIC Digester

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(Autonomous Institution – UGC, Govt. of India)
SUB: GREEN ENERGY SYSTEMS
MODEL QUESTION PAPER-VI
III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. What is geothermal power?
2. What are the classifications of geo thermal fields
3. Describe a vapor dominated or dry steam field
4. Discuss the disadvantages of geothermal plant
5. Write about the concept of interconnecting geo thermal-fossil system
6. Discuss the advantages of geothermal plant
7. What is the potential of geothermal energy in India
8. Explain the working of a vapor-dominated power plant
9. What are the types of liquid dominated hydrothermal convective systems
10. Explain the applications of geothermal energy

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1 What are the classifications of geo thermal sources

(OR)

2 Explain Hot Dry rocks (petro thermal) resources of geothermal energy and how they can be exploited as a source of energy

3 Explain vapour dominated hydrothermal power plant with neat sketch and its representation on T-S diagram

(OR)

4 With the help of neat diagram, explain the working of geo thermal- preheat hybrid

5 Explain how electrical energy can be generated from geothermal energy

(OR)

6 With the help of neat diagram, explain the working of geo thermal- preheat hybrid system

7 What are liquid dominated hydrothermal Convective systems? Write about them

(OR)

8 With the help of a neat diagram, explain the working of a liquid dominated single flash steam system

9 Explain the fossil superheat hybrid system with a neat schematic

(OR)

10 Explain the application of geothermal energy

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(Autonomous Institution – UGC, Govt. of India)
SUB: GREEN ENERGY SYSTEMS
MODEL QUESTION PAPER-VII
III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1. Explain the different types of energy that can be generated from ocean
2. Explain in brief the principles of OTEC energy utilization
3. Explain in brief the principles of obtaining energy from the tides
4. What are the advantages and limitations of tidal power generation
5. What are the classifications of small hydro power stations
6. Explain how electrical energy can be generated from tidal plant
7. What are the main types of OTEC power plants
8. Write short note about wave energy conversion methods
9. Explain in brief the single basin arrangement
10. Mention the advantages of small scale hydroelectric power generation

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1 Explain the principle on which OTEC plants are based on

(OR)

2 Explain OTEC open cycle

3 Explain OTEC closed (Anderson)cycle

(OR)

4 What are the advantages and limitations of wave energy

5 Explain in brief about wave energy conversion devices

(OR)

6 Explain in detail about mini hydelplants

7 What is the minimum tidal range required for the working of tidal power plant?

(OR)

8 Draw the schematic layout of a tidal powerhouse

9 Explain how power can be generated using single basin arrangement in detail

(OR)

10 Explain the difference between single Basien and double basien arrangements

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(Autonomous Institution – UGC, Govt. of India)

SUB: GREEN ENERGY SYSTEMS

MODEL QUESTION PAPER-VIII

III YR II SEMESTER

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

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1.What is meant by Direct Energy Conversion
2. Explain Carnot cycle?
3. What is joule Thomson effect
4. Explain The Principle Of Thermo Electric Power Generator
5. Explain the performance analysis of thermo electric power generator
6. What is See beck Thermo Electric Effect
7. What is meant by Direct Energy Conversion
8. Derive the expression for the power and efficiency of thermionic generator
9. What are the advantages of MHD generation
10.Explain the materials used for MHD generation

PART B **Max Marks: 50**

i. Answer only one question among the two questions in choice.

ii. Each question answer (irrespective of the bits) carries 10M.

1 What is meant by Direct Energy Conversion

(OR)

2 Explain Carnot cycle?

3 What is joule Thomson effect

(OR)

4 What is See beck Thermo Electric Effect

5 What are MHD generators? Explain its principle and working

(OR)

6 Explain about various fuel cells and its applications

7 Explain the working of a thermoelectric generator

(OR)

8 Explain the advantages and disadvantages of direct energy conversion

9 Explain the working of a See beck effect thermocouple

(OR)

10 Write short notes on superconductivity and gas conductivity

AIRCRAFT SYSTEMS
MODEL PAPERS-1

Answer all the questions: 25M

1. Enumerate different types of aircraft systems. [3]
2. Explain about any one Mission system of transport aircraft. [2]
3. Explain about reverse bootstrap system. [2]
4. Explain about g-tolerance. [3]
5. Explain electrical loads of an aircraft. [2]
6. Explain about DC-link. [3]
7. Brief about accumulator working principle. [3]
8. Brief about Landing gear operation. [2]
9. List out the typical start sequence. [3]
10. List out the mode of operation of fuel systems. [2]

Answer any one from each section: 50M

1. Classify and discuss about the a/c systems [10]

   (or)

   Explain the integration of a/c system on process , information, and function levels with required sketches and tables. [10]
2. Explain in detail the electrical system components and working with a schematic diagram [10]

   (or)

   Explain in detail FBW system its components nomenclatures by taking any example.
3. Explain the components and working principle of a hydraulic system. [10]

   (or)

   Explain the brake management system with neat sketches. [10]
4. Explain about refrigeration systems and types with neat sketches [10]

   (or)

   Explain the process and types of passenger & crew evacuation/ejection system .
5. Explain in detail various modes of fuel system [10]

   (or)

   Explain the engine control evolution, fuel flow control, control system parameter with some examples. [10]

AIRCRAFT SYSTEMS
MODEL PAPERS-2

Answer all the questions: 25M

1. Enumerate levels of integration of aircraft systems at component levels. [3]
2. Explain about any one Mission system of fighter aircraft. [2]
3. Brief about the bleed air [3]
4. Brief about air cycle refrigeration. [2]
5. Brief about primary and secondary control systems of a/c. [3]
6. Brief about a cyclo converter working priciple. [2]
7. Enumerate the basic components of hydraulic system. [2]
8. Discuss about reservoir, pump and its working principle. [3]
9. List out the main components of fuel system. [2]
10. Explain about functions of sensors in engine control system. [3]

Answer any one from each section: 50M

1. Explain the purpose, location brief description, aspects/safety of navigation & cockpit displays systems with sketches and tables showing 3 examples each. [10]

   (or)

   Explain the drivers in the product of environment operating environment. [10]
2. Explain the working of a pneumatic system with a neat sketch [10]

   (or)

   Explain about ram air cooling and fuel cooling with sketches. [10]
3. Explain the flight primary and secondary flight controls for civil and fighter a/c. [10]

   (or)

   Explain the terms

   a. Cyclo-converter b. DC-link c. Generator d. VSCF [3,2,3,2]
4. Explain the terms with sketches

   a. Accumulator b. Relief Valve c. Pump d. reservoir [3,2,3,2]

   (or)

   Explain what do you mean by redundancy, types and applications. [10]
5. Explain the factors involved in engine starting control. [10]

   (or)

   Explain the terms

   a. Booster pumps b. Transfer valves c.NRV d. fuel gauging probes [3,2,3,2]

AIRCRAFT SYSTEMS
MODEL PAPERS-3

Answer all the questions: 25M

1. Explain about ADF working with a sketch. [3]
2. Explain about ILS & MLS [2]
3. Explain about Cyclo converter. [2]
4. Explain about Load protection. [3]
5. Explain anti-ice technique. [2]
6. Explain molecular sieve oxygen concentrator. [3]
7. Explain the functions of reservoir. [3]
8. Brief about importance of redundancy [2]
9. List out the typical start sequence. [3]
10. List out the mode of operation of fuel systems. [2]

Answer any one from each section: 50M

1. Discuss on:
   Airframe Systems Vehicle Systems Avionics Systems Mission Systems [2, 3 ,2 ,3]
   (or)
   What are the level of integration involved in aircraft production. [10]
2. Explain the following
   Primary & Secondary flight control [6]
   Control linkages [4]
   (or)
3. Explain the terms:
   Power conversion [4]
   VSCS [3]
   DC link. [3]
4. Explain the basic principle on which hydraulic system works? What are the main components of hydraulic system? [10]
   (or)
   Explain the landing gear system operation with neat sketches. [10]
5. Explain about air refrigeration systems and types with neat sketches [10]
   (or)
   Explain the process and types of passenger & crew evacuation/ejection system .
6. Explain in detail control of fuel flow and air flow [10]
   (or)

Explain the engine control evolution, fuel flow control, control system parameter with some examples. [10]

AIRCRAFT SYSTEMS
MODEL PAPERS-4

Answer all the questions: 25M

1. Enumerate levels of integration of aircraft systems at system levels. [3]
2. Explain about any one avionics system of fighter aircraft. [2]
3. Brief about the fuel cooling [3]
4. Brief about Pitot static system. [2]
5. Brief about how actuation is important in control surface. [3]
6. Brief about a cyclo converter working priciple. [2]
7. Explain the types of pumps used in a/c. [2]
8. Discuss about reservoir, pump and its working principle. [3]
9. List out the main components of fuel system. [2]
10. Explain about functions of sensors in engine control system. [3]

Answer any one from each section: 50M

1. Explain how the operating environment conditions of an aircraft are maintained. [10]

   (or)

   Discuss the aspects of safety and integrity of aircraft for any 4 systems. [10]
2. Explain the working of a cabin pressurization system with a neat sketch [10]

   (or)

   a. Explain about g-tolerance and protection with sketches. [3]

   b. Explain working and principle of boots trap and reverse bootstrap [7]
3. Explain the electrical load management systems. [10]

   (or)

   Explain the terms

   a. Load protection b. DC-link c. Generator d. Redundancy [3,2,3,2]
4. Explain in detail the flight control actuation importance and need

   (or)

   Explain what do you mean by redundancy, types and applications. [10]
5. Explain the full authority and limited authority control systems. [10]

   (or)

   Explain the terms

   a. Exhaust gas flow b. Fuel flow control [5,5]

AIRCRAFT SYSTEMS
MODEL PAPERS-5

Answer all the questions: 25M

1. Explain about integration. [3]
2. Explain about any one vehicle system of transport aircraft. [2]
3. Explain about VSCS. [2]
4. Explain about spoiler and flap. [3]
5. Explain reservoir and pump functions. [2]
6. Explain the importance of redundancy. [3]
7. Brief about fuel cooling working principle. [3]
8. Brief about cabin pressurization operation. [2]
9. Explain the control of fuel. [3]
10. Explain mode of operations of fuel systems. [2]

Answer any one from each section: 50M

1. Explain about the operating environment conditions [10]

   (or)

   Explain the integration of a/c system on system and function levels with required sketches and tables. [10]
2. Describe electrical system components and working principle with a schematic diagram [10]

   (or)

   Explain in detail FBW system its components nomenclatures by taking any example.
3. Discuss the working principle of a hydraulic system with a neat sketch. [10]

   (or)

   Explain the brake management system with neat sketches. [10]
4. Explain about engine as a source of high pressure operating techniques [10]

   (or)

   Explain the process and types of passenger & crew evacuation/ejection system .
5. Explain in detail various modes of fuel system [10]

   (or)

   Explain the engine control evolution, fuel flow control, control system parameter with some examples. [10]

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AERONAUTICAL ENGINEERING

III B. TECH. II SEM. (R15)

FINITE ELEMENT ANALYSIS

QUESTION BANK

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

SUB: FEA

MODEL PAPER 1

PART A (25 MARKS)

1. a. What is meant by Engineering analysis and specify its Types (2M)
   b. What is Hermite shape function (3M)
   c. Write the equilibrium equations for 3D body (2M)
   d. What is coordinate system. specify the types and explain (3M)
   e. What is meant by axi-symmetric problems (2M)
   f. Derive the shape functions for 2D truss element (3M)
   g. What is the degree of freedom for the thermal problems (2M)
   h. Distinguish between CST and LST (3M)
   i. Write the dynamic equation of motion for the undamped free vibrations (2M)
   j. Determine the Area of the triangle A(2,2),B(7,4) ,C(3,6) (3M)

PART B (10X5=50 MARKS)

2. a) Derive the equations of equilibrium in case of a three dimensional stress system.

   b) Discuss the advantages and disadvantages of FEM over
   (i) Classical method
   (ii) Finite difference method.

OR

3.a) Solve the differential eqationfor the physical problem expressed as $d^2y/dx^2+100=0$when $0=x=10$ with boundary condition as $y(0)=0$ and $y(10)=0$ using i) point collocation ii) sub-domain collocation iii) least square method
iv) galarkin method

b) Write the Strain displacement equations for three dimensional system

4. a) Determine the nodal displacement, Element stresses for axially loaded bar as shown in the fig. below

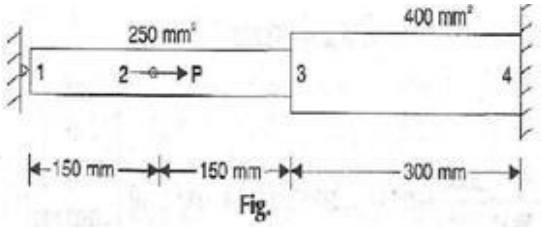


Fig.

b) Derive the strain displacement matrices for triangular element of revolving body.

OR

5 a) For the beam shown in Figure below, determine the following: a) Slopes at nodes 2 and 3

b) Vertical deflection at the mid-point of the distributed load. Consider all the elements have E=200GPa, I=5X10^6 mm^4

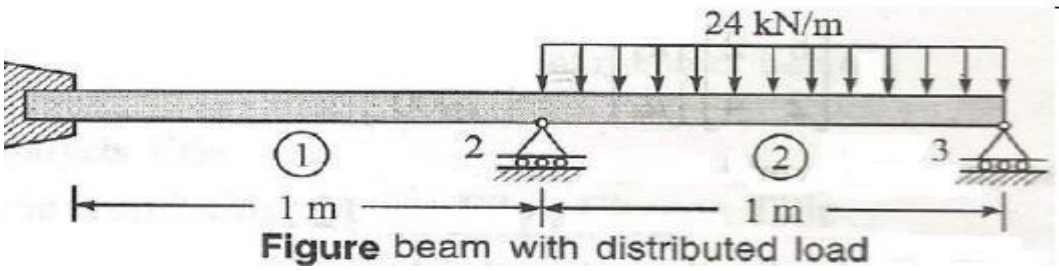
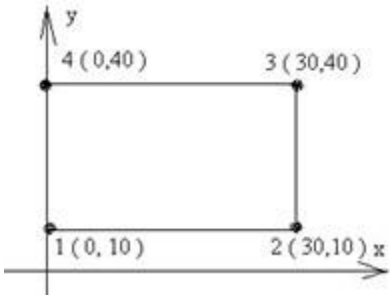


Figure beam with distributed load

6. a) For the element shown in the figure, assemble Jacobian matrix and strain displacement matrix

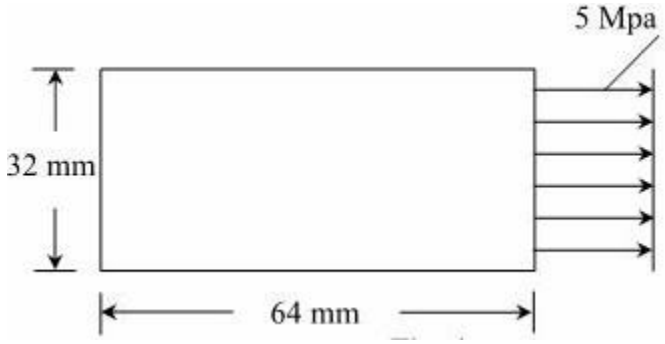


b) Determine the shape functions for a 8 node quadratic quadrilateral Evaluation element(boundary noded).

OR

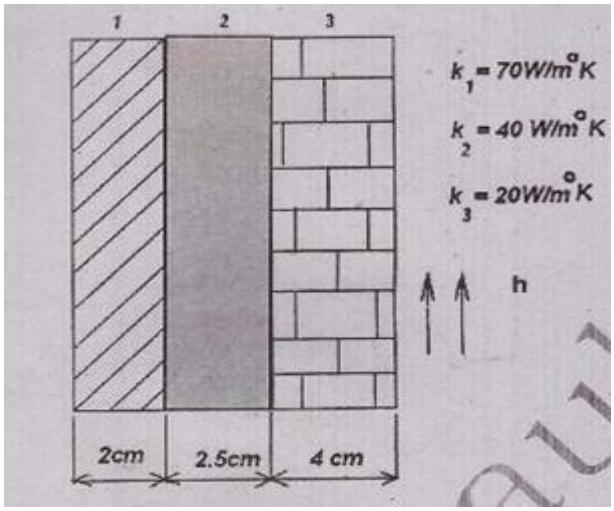
7. a) Establish the shape functions for a 3 – noded triangular element

b) Find the deformed configuration, and the maximum stress and minimum stress locations for the rectangular plate loaded as shown in the fig. Solve the problem using 2 triangular elements. Assume thickness = 10cm; E = 70 Gpa, and υ = 0.33



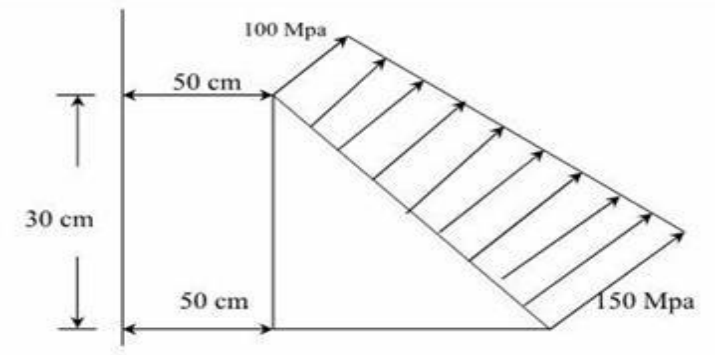
8, The composite wall consists of three materials shown in figure. The inside wall temperature is at 200^{0}C and the outside air temperature is 50^{0}C with a convection coefficient of 10 W/m^2 ^{0}C·Determine

the temperature along the composite wall

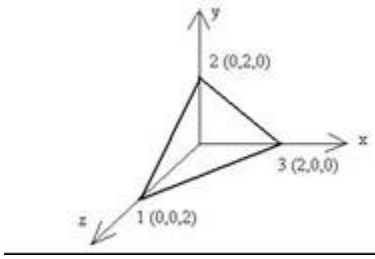


9.a) Derive one dimensional steady state heat conduction equation.

b) An axisymmetric triangular element is subjected to the loading as shown in fig. the load is distributed throughout the circumference and normal to the boundary. Derive all the necessary equations and derive the nodal point loads.



10. a)Determine the strain displacement matrix for the TETRAHEDRAL element as shown in fig



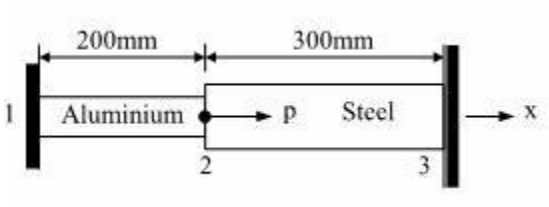
b) Explain the concept of numerical integration and its utility in generating Isoperimetric finite element matrices

OR

11. a) What are the necessary requirements for convergence and explain about h- and p

requirements

b) Derive the stiffness matrix for truss element in case of linear and quadratic shape functions At 20^0 C an axial load P = 300 x 10^3 is applied to the rod as shown in Fig. The temperature is then raised to 60^0C. Assemble the element stiffness matrix and the element temperature force matrix (F). Again determine the nodal displacements and element stresses. Also find element strains. Assume E_1= 70 x 10^9 N/m^2, $_1$= 900 mm^2, α_1 = 23 x 10^{-6}/ ^{0}C, E_2 = 200 X 10^9 N/m^2 , A_2 = 1200mm^2 ,α 2= 11.7 x 10^{-6} / ^{0}C.



MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

SUB: FEA

MODEL PAPER 2

PART A

(25 MARKS)

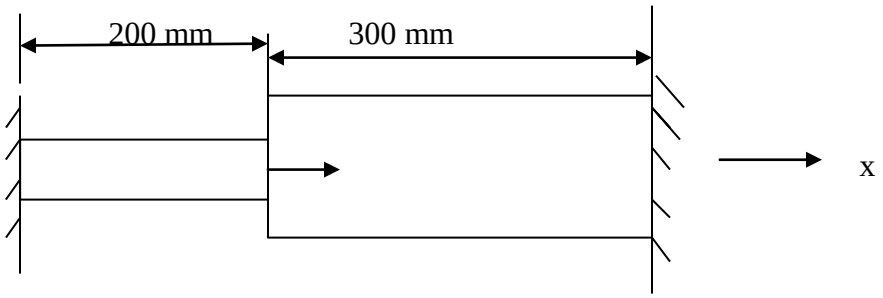
1. a. What is FEM (2M)
   b. Write the advantages of FEM (3M)
   c. What is CST (2M)
   d. Write the strain relations of three dimensional system (3M)
   e. What is local coordinate System (2M)
   f. Write the Eigen values and Eigen vectors for a stepped bar (3M)
   g. What is the degree of freedom for the thermal problems (2M)
   h. Define principle of virtual work. Describe the FEM formulation for 1D bar element (3M)
   i What is dynamic analysis (2M)
   j. Discuss Mess generation(3M)

PART B **(10X5=50 MARKS)**

2.. a) Differentiate among Bar element, Truss element and Beam element indicating D.O.F and geometry characteristics.

b) An axial load P =$300X10^3$N is applied at 20^0 C to the rod as shown in Figure below. The temperature is the raised to 60^0 C a) Assemble the K and F matrices

b) Determine the nodal displacements and stresses



$E_1=70X10^9N/mm^2$ $E_2=200X10^9N/mm^2$

$A_1=900mm^2$ $A_2=1200mm^2$

$\alpha_1=23X10^{-6}$ $\alpha_2=11.7X10^{-6}$

3. a) Discuss in detail about the concepts of FEM formulation How is that emerged as powerful tool. Discuss in detail about applications of finite element method

b) Derive an equation for finding out the potential energy by Rayleigh –Ritz method Using Rayleigh – Ritz method, find the displacement of the midpoint of the rod shown in Fig. Assume E = 1,A=1,ρg=1 by using linear and quadratic shape function concept

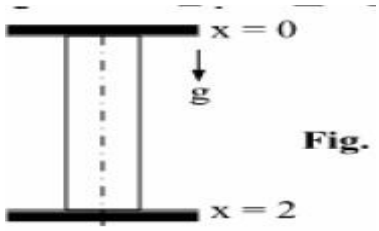


Fig.

4 a) Discuss in detail about Linear and Quadratic shape functions with examples

b) Consider axial vibration of the Aluminum bar shown in Fig., (i) develop the global stiffness and (ii) determine the nodal displacements and stresses using elimination approach and with help of linear and quadratic shape function concept. Assume Young's Modulus E = 70Gpa

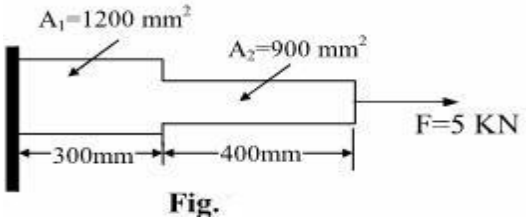


Fig.

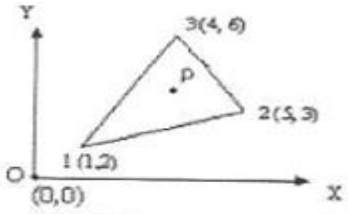
OR

5. a)Describe Rayleigh-Ritz method

b) Abeam is fixed at one end and supported by roller at the other end has 20KN load applied at the center of the span of 10m.Calculate deflection and slope and also construct shear fore and bending moment diagrams

6. a) State the properties and applications of CST

b) The nodal coordinates of the triangular element shown in figure at the interior point P.the x coordinate is 3.3 and the shape function at node 1 is $N_1$is 0.3.determine the shape functions at nodes 2 and 3 also find the 'y' coordinate of P



OR

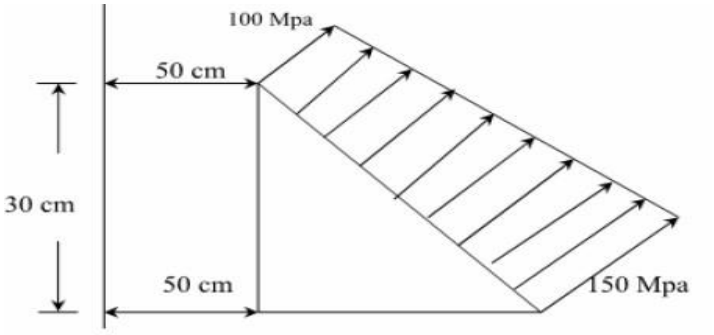
7. a) Determine the stiffness and Jacobian matrix for the iso parametric quadrilateral element starting from fundamentals.

b) Differentiate between axi- symmetric boundary condition and polar symmetric boundary condition.

c) Derive the load vector for the axi-symmetric triangular element with the variable surface load on the surface.

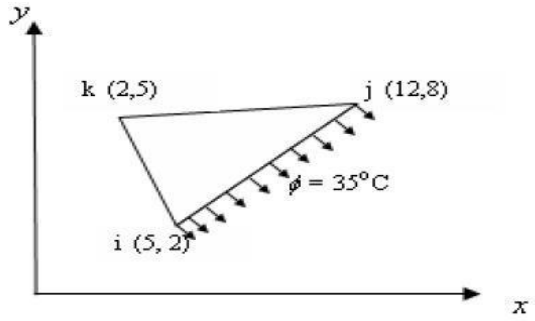
8. a) derive one dimensional steady state heat conduction equation

b)An axi symmetric element subjected to loading as shown in figure .The load is distributed througout the circumference and normal to the boundary. Derive all necessary equations and derive nodal point loads



OR

9. Calculate the conductance matrix [K(e)] and load vector fF(e)g for the triangle element shown in figure 8. The thermal conductivities are kx = ky = 4 W=cm^{0}C and h = 0.3 W/cm2 0C. Thickness of the element is 1cm. All coordinates are given in cms. Convection occurs on the side joining modes i and j.



10. For the stepped bar shown in figure develope the global stiffness matrix and mass matrices and determine the natural frequencies and mode shapes Assume E=200GPa and mass density is 7850 Kg/m^3 L_1=L_2=0.3 m A_1=350 mm^{2}and A_2 =600 mm^2

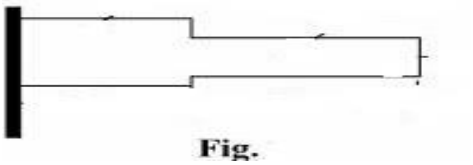


Fig.

OR

11. a)Derive the shape functions for the four noded tetrahedron element from the first principles

b)discuss the importance of semi automatic meshing and practical applications

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

SUB: FEM

MODEL PAPER 3

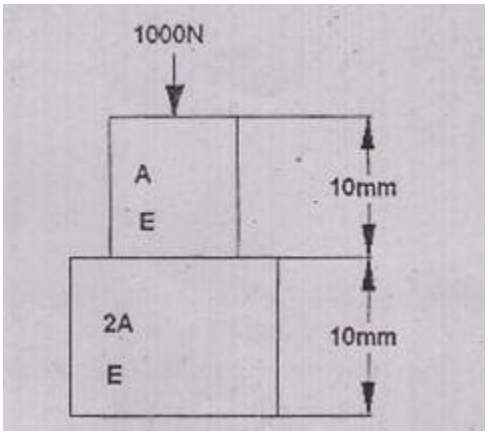
PART A

(25 MARKS)

1. a. List the various weighted residual methods (2M)
   b. Write the properties of shape function (3M)
   c. What the advantages of natural coordinate system (2M)
   d. Write analogies between structural, heat transfer and fluid mechanics (3M)
   e. Name few FEA packages (2M)
   f. Derive the mass matrix for a 1D linear bar element (3M)
   g. What are the properties of stiffness matrix (2M)
   h. Explain about plain stress and plain strain conditions (3M)
   i. Write down the conduction matrix for a three noded triangular element (2M)
   j. Distinguish between Error in solution and Residual (3M)

PART B (10X5=50)

2. a)Determint the nodal displacement ,stress and strain for the bar shown in fig



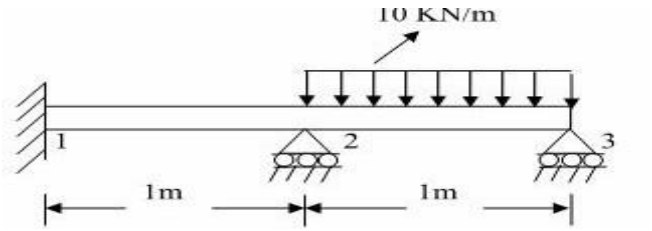
b) Using potential energy approach, describe FE formulation for plane truss Element

OR

3.a) Solve the differential equation for the physical problem expressed as $d^2y/dx^2+100=0$when 0=x=10 with boundary condition as y(0)=0 and y(10)=0 using i) point collocation ii) sub-domain collocation iii) least square method iv) galarkin method.

b) Explain the concept of FEM briefly .outline the steps involved in FEM along with applications

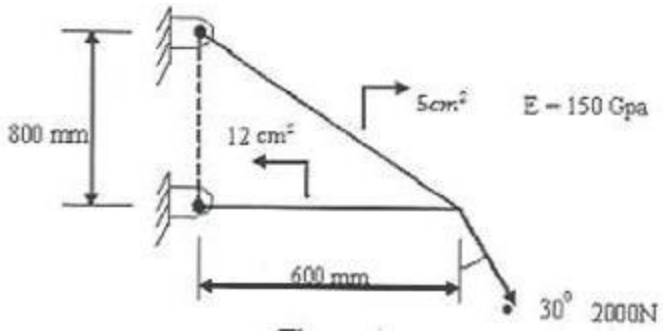
4. a)For a beam and loading shown in fig., determine the slopes at 2 and 3 and the vertical deflection at the midpoint of the distributed load



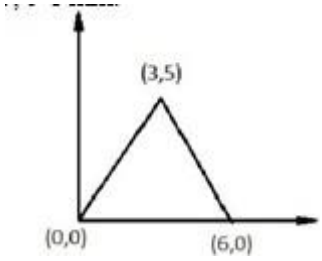
b) Establish the shape functions for a 3 – noded triangular element.

OR

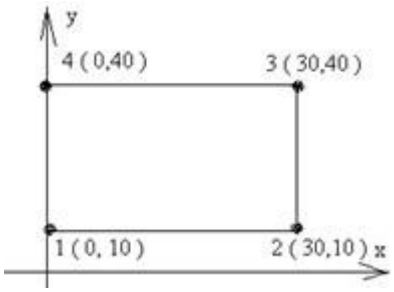
5. Calculate the nodal displacement, stresses and support reactions for the truss shown in figure



6.a) Evaluate the element stiffness matrix for the triangular element shown under plane strain condition. Assume the following values E=200 GPa, μ=0.25, t=1 mm



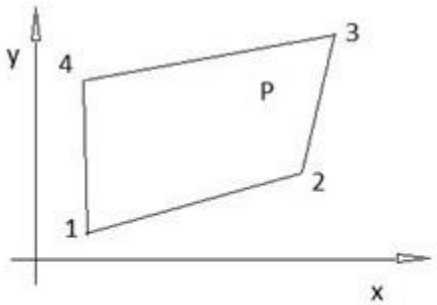
b) For the element shown in the figure, assemble Jacobian matrix and strain displacement matrix



OR

7. a) Derive the a)shape function and b) strain displacement matrices for triangular element of revolving body

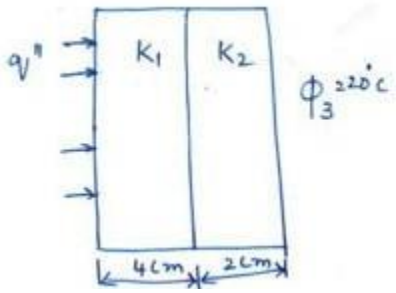
b) For the Isoparametric quadrilateral element shown in fig , determine the local co-ordinates of the point P whose Cartesian co=ordinates as(6,4)



node	x	y
1	2	1
2	5	2
3	7	6
4	1	5

8 a) Determine the temperature at the nodal interfaces for the two layered wall shown in fig.the left face is supplied with heat flux of Q^{11}=5 W/cm^2 and the right face is maintained at 20^{0}C

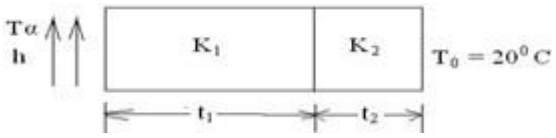
Q^u=5w/c
m^2
K_1=0.2W/cm^{0}C
K_2=0.06W/cm^{0}C
A=1cm^2.



b) Derive the Strain displacement Matrix for 2D-Thin plate. Consider the temperature field with in the triangular element is given by T= $N_1T_1 + N_2T_2 + N_3T_3$

OR

9. Determine the temperature distribution through the composite wall shown in figure, when convection heat loss occurs on the left surface. Assume unit area Assume wall thickness t_1 = 4cm, t_2 = 2cm, k_1 = 0.5w/cm^{0}c, k_2 = 0.05w/cm^{0}c h= 0.1w/cm^2 ^{0}c and T_α= -5^{0}c



10. a) Determine the eigen values and the associated Eigen vectors of the matrix [A] given by

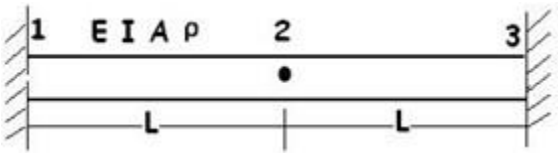
$$A = \begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}$$

b) State the properties of Eigen Values.

OR

11.a) Explain difference between Lumped Mass and Consistent Mass

b) Determine the Natural frequency of the beam shown in the figure



MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

SUB: FEM

MODEL PAPER 4

PART A

(25 MARKS)

1. a. Give the limitations of FEM. (2M)
   b. Briefly explain the role of shape function FEM analysis (3M)
   c. Write a short note on numerical integration. (2M)
   d. What do you understand by discritisation of the domain (3M)
   e. What is Jocobian matrix (2M)
   f. Determine the matrix relating strains and nodal displacements for an axisymmetric triangular element. (3M)
   g. What is difference between CST and LST (2M)
   h. What are the ways by which a 3D problem can be reduced to a 2D problem (3M)
   i. Name Few FEA packages (2M)
   j. Derive the convection matrix for a 1D linear bar element (3M)

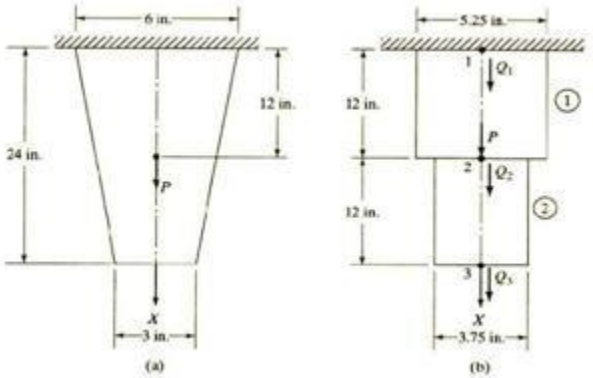
PART B

(10X5=50)

2. **a)** Write down expressions for the element stiffness matrices and element body force vectors

b) Evaluate the stresses in each element Determine the reaction force at the support. consider 1in=1cm for SI UNITS

a



OR

3.a) Determine the nodal displacement, Element stresses f r axially loaded bar as shown in the fig. below

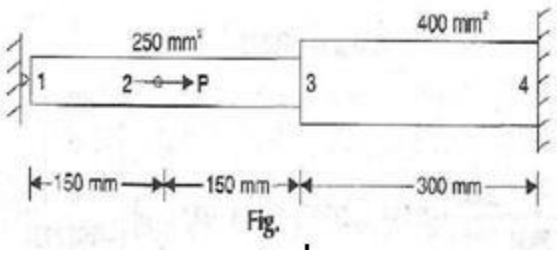
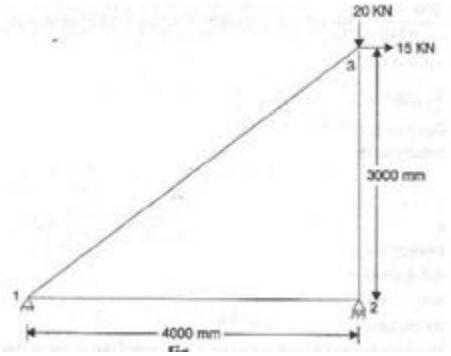


Fig.

b) Explain the elimination method and penalty method for imposing specified displacement boundary conditions

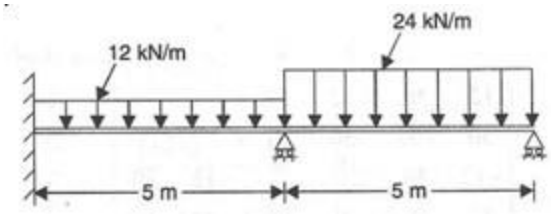
4. a) Obtain the forces in the plane Truss shown in Figure below and determine the support reactions also. Take E=200GPa and A= 2000mm^2



b) Derive the Hermite shape functions for beam element.

OR

5.a) Analyze the beam shown in Figure method and determine the end reactions. Also determine the below by finite element deflections at mid spans given E=2X10^{5}N/mm^2, and I=5X10^6 mm^4



b) What are the general features of a bar Element?

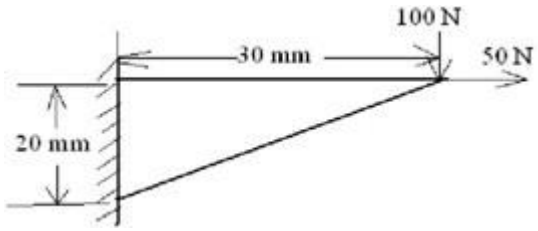
6. a) Formulate the finite element equations for Constant strain triangle shown in fig. Assume plane stress E=200Gpa,ν=0.25,thickness=5mm,nodal co-ordinates. Pressure on 1-2 edge is 5N/mm2

X1=1	X2=5	X3=3
Y1=2	Y2=4	Y3=6

b) Write the Advantages of iso-parametric elements

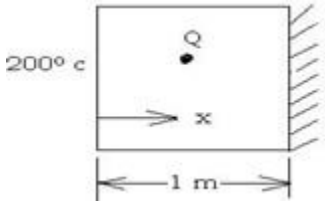
OR

7.a) For the configuration shown in figure, determine the deflection at the point load application using a one element model. T = 10 mm , E = 70 G Pa ,ν = .3



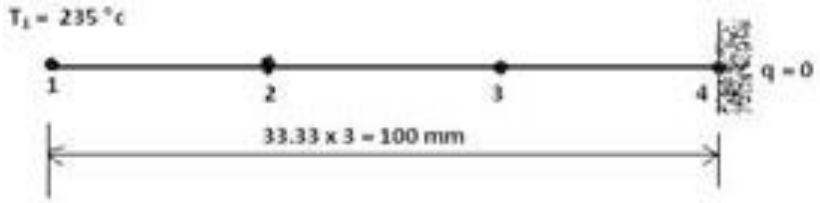
b) Derive the strain displacement matrix for triangular element.

8. a) The plane wall shown in fig. The thermal conductivity K = 25 /m^0C and there is a uniform generation of heat in the wall Q = 400 W /m^3. Determine the temperature distribution at five nodes (include two sides of the walls) in equal distances through the wall thickness



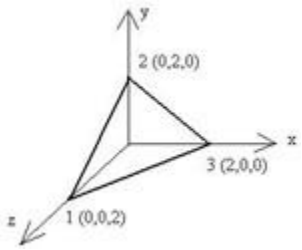
b) Derive Approximate the first two natural frequencies of a cantilever beam using one element model. EI=Flexural rigidity

9. a) A metallic fin with thermal conductivity K=360W/m^0c, 1mm thick and100mm long extends from a plane wall whose temperature is 235^0c. Determine the distribution and amount of heat transferred from the fin to air at 20^0c with h= 9W/m^{20}c take width of the fin is 1000 mm. Assume tip is insulted

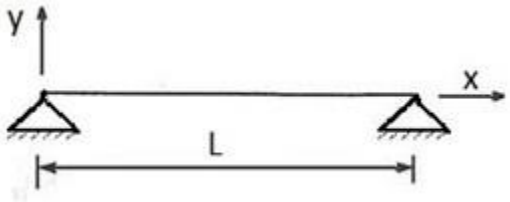


b) Explain the concept of numerical integration and its utility in generating Isoperimetric finite element matrices

10.a) Determine the strain displacement matrix for the TETRAHEDRAL element as shown in fig



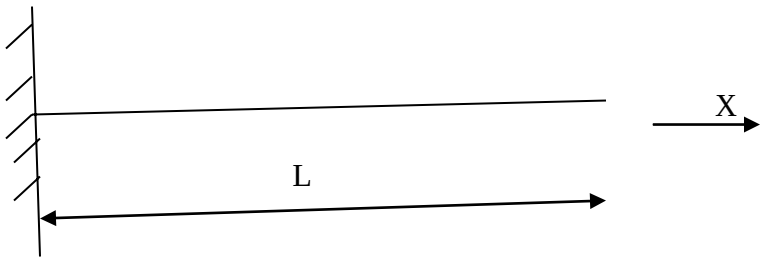
b) Determine the approximate first two natural frequeneves of a simply supported beam using on a element. Flexural Rigidity =EI; Density = Ƥ Cross-sectional area=A



OR

11.a) State the method used for obtaining natural frequencies and corresponding eigen vectors.

b) Evaluate natural frequencies for the CANTI LEVER beam shown in fig USING ONE ELEMENT



MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

SUB: FEM

MODEL PAPER 5
PART A

(25 MARKS)

1. a. What is the principle of FEM (2M)
   b. Write the stress strain relations for 2D plane stress and pane strain conditions (3M)
   c. Differentiate between truss and beam element based on degree of freedom. (2M)
   d. What is Hermite shape function (3M)
   e. Write the formula for the load vector of triangular element subjected to body force (2M)
   f. What is the size of stiffness matrix for axisymmetric triangular element (3M)
   g. What is the degree of freedom for the thermal problems (2M)
   h. Where do you apply (3M)
   i. Name Few FEA packages (2M)
   j. Explain the importance of lumped mass matrix (3M)

PART B 10X5=50

2. a)Why polynomial type of interpolation function is preferred over trigonometric functions? Explain

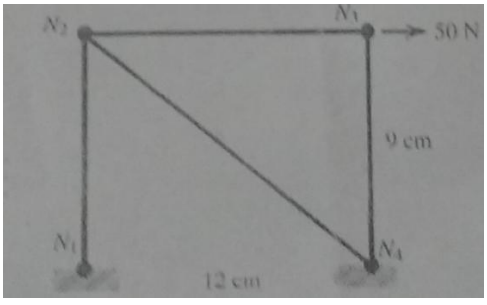
b)Draw the Pascal's triangle and Pascal's tetrahedron for understanding the interpolations functions. Explain the salient features

OR

3. a)Explain the steps involved in obtaining an appropriate solution using AEM

b) Explain the equilibrium state of the system, when the system is subjected to different types of loads and explain the stress and equilibrium relations

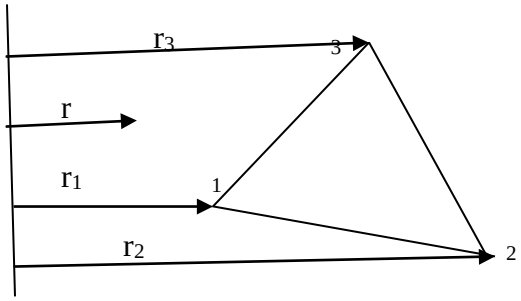
4.For a two dimensional structure as shown in figure. determine displacement of the nodes and normal stresses developed in the members using FE. Use E = 39x 106 N/cm2 and the diameter of the cross-section of 0.25 cm.



OR

5. A beam is fixed at one end and supported by a roller at the other end, has a 20 KN concentrated load applied at the center of the span of 10 m. Calculate the deflection and slope and also construct shear force and bending moment diagrams and take I=2500 cm^4

6.a) Evaluate the axisymmetric stiffness matrix K of the triangular element shown in the figure .Consider the coordinates of the nodes (2,1), (4,00, and (3,2).also assume E= 2.6 GPa and v=0.2



b) Difference between CST and LST with respect to the triangular element.

OR

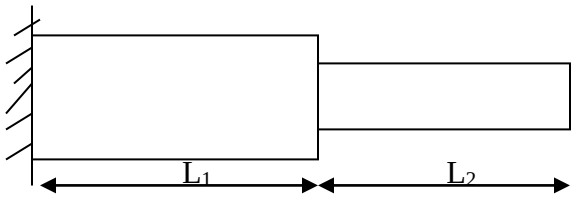
7.Derive the stiffness matrix for the four noded quadrilateral element in terms of natural coordinate systems

8.consider a brick wall of thickness 0.3 m ,k=0.7 W/m/K. The inner surface is at 28^0C and the outer surface is exposed to cold air at -15^0C.The heat transfer coefficient associated with the outside surface is 40W/m^2K.Determine the steady state temperature distribution within in the wall and also the heat flux through the wall. Use two elements and obtain the solution

OR

9.Derive the conductivity matrix for two dimensional triangular element subjected to convection on one face of the element

10. For the stepped bar shown in figure. Develop the global stiffness and mass matrices and also determine the natural frequencies and mode shapes. Assume E=200 GPa and mass desity =7850 Kg/m^3 L_1=L_2=0.3 m A_1=350mm^2 A_2=600 mm^2



OR

11.a)Derive the shape functions for the four noded tetrahedron element from the first principle

b)discuss the importance of semi automatic meshing and auto mesh along with the practical applications

CONTROL THEORY FOR AIRCRAFT (R15A2113)

Q[illegible]

III B. Tech II Semester

(2018-2019)

Prepared By

Associate Professor L Sushma

Department of Aeronautical Engineering

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2015 Certified)

Maisammaguda, Dhulapally (Post Via. Kompally), Secunderabad – 500100, Telangana State, India.

MRCET VISION

- To become a model institution in the fields of Engineering, Technology and Management.
- To have a perfect synchronization of the ideologies of MRCET with challenging demands of International Pioneering Organizations.

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To establish a pedestal for the integral innovation, team spirit, originality and competence in the students, expose them to face the global challenges and become pioneers of Indian vision of modern society.

MRCET QUALITY POLICY.

- To pursue continual improvement of teaching learning process of Jndergraduate and Post Graduate programs in Engineering & Management vigorously.

To provide state of art infrastructure and expertise to impart the quality education.

PROGRAM OUTCOMES

(PO's)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design / development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a

member and leader in a team, to manage projects and in multi disciplinary environments.

12. **Life- long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

EDUCATIONAL OBJECTIVES – Aeronautical Engineering

1. **PEO1 (PROFESSIONALISM & CITIZENSHIP):** To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, ecological and economic issues.

2. **PEO2 (TECHNICAL ACCOMPLISHMENTS):** To provide knowledge based services to satisfy the needs of society and the industry by providing hands on experience in various technologies in core field.

3. **PEO3 (INVENTION, INNOVATION AND CREATIVITY):** To make the students to design, experiment, analyze, and interpret in the core field with the help of other multi disciplinary concepts wherever applicable.

4. **PEO4 (PROFESSIONAL DEVELOPMENT):** To educate the students to disseminate research findings with good soft skills and become a successful entrepreneur.

5. **PEO5 (HUMAN RESOURCE DEVELOPMENT):** To graduate the students in building national capabilities in technology, education and research

PROGRAM SPECIFIC OUTCOMES – Aeronautical Engineering

1. To mold students to become a professional with all necessary skills, personality and sound knowledge in basic and advance technological areas.

2. To promote understanding of concepts and develop ability in design manufacture and maintenance of aircraft, aerospace vehicles and associated equipment and develop application capability of the concepts sciences to engineering design and processes.

3. Understanding the current scenario in the field of aeronautics and acquire ability to apply knowledge of engineering, science and mathematics to design and conduct experiments in the field of Aeronautical Engineering.

4. To develop leadership skills in our students necessary to shape the social, intellectual, business and technical worlds.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year . Tech, ANE-II Sem	L	T/P/D	C
	4	1/-/-	3

(R15A2113) CONTROL THEORY FOR AIRCRAFT

Objectives:

- To acquire the student with method of modeling,
- Performance analysis of control system and
- Application to aircraft control system.

UNIT I: Control System modelling and feedback control:

Basic components of control system, open loop system, closed loop system, effect of feed back on overall gain, stability, sensitivity & on noise, Linear Vs Non- linear system, Time-invariant Vs time varying systems. Modelling of dynamical system by differential equations. Linearization of non-linear system. System type, steady state error, error constant. Composition, reduction of block diagrams of complex systems-rules and conventions. Control system components- sensors, transducers, servomotors, actuators, filters, modelling, transfer function.

UNIT-II: **Time Domain & Frequency Domain Analysis.**

Control system performance, time domain description, output response to control inputs. Characteristic parameters-relation to system parameters. Review of Laplace Transform, applications to differential equations, Poles and zeroes, partial fraction decomposition of transfer function. Frequency domain analysis, specification: resonant peak, resonant frequency and band width. Bode Plot, Polar plot. Experimental determination of transfer function by frequency response measurement.

UNIT-III: Design of Control System.

Control system performance requirements, transient and steady state specification. Example of first and second order system. Method of determining stability- Routh-Hurwitz Criterion. Design of controllers: active, passive, series, feed forward, feedback controller. Proportional, integral. Proportional plus derivative control. Lead, lag, lead-lag, wash-out, notch filters: properties and transfer functions. Gain scheduling, Adaptive control-definition, merits.

Stability of closed loop system, Root Locus method of analysis and compensation. Nyquist Criterion, gain margin and phase margin.

UNIT-IV : Aircraft response to control- Flying Qualities, Stability and Control Augmentation, Auto pilots.

Approximation to aircraft transfer functions, Flying qualities of aircraft, relation to airframe transfer function. Pilot opinion rating. Stability Augmentation system- displacement & rate feed- back, Full authority fly-by-wire control, need for automatic control. Auto pilots- purpose, functioning, displacement auto pilot, pitch, yaw, bank, altitude and velocity hold auto pilot. Auto pilot design by displacement feedback & series PID Controller- Zeigler and Nichols method.

UNIT-V: Modern Control Theory

Limitations of classical control system modelling, multi input multi output systems. State space modelling of dynamical systems, state variable-definition-state equations. The output variable-the output equation. Representation by vector matrix first order differential equations. Matrix transfer function, state transition matrix- matrix exponential, properties, Numerical solutions of state equations, examples. Canonical transformation of state equations, Eigen values, real distinct, repeated. Controllability and observability- definition-significance. Digital control system: over view- advantages, disadvantages.

Text Books:

1. KUO, BC. Automatic Control systems, prentice hall India, 1992 ISBN 0-87692-B3-0
2. Nelson R.C. Flight Stability and Automatic control, second edition, tata McGraw-hill2007 ISBN 0-07-666110-3
3. Yechout, T.R , Introduction to flight Mechanics, AIAA,2003,ISBN 1-56347-577-4

Reference: Mc Lean, D. Automatic flight Control Systems, prentice hall, 1990

Outcomes:

- The student should be able to model a control system.
- He should be able to estimate the performance of a specified control system including aircraft flight control system.
- He will have good understanding of modern control design methods.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

(UGC AUTONOUMOUS – Govt. of INDIA)

III B.TECH. II SEMESTER – AERONAUTICAL

CONTROL THEORY FOR AIRCRAFT (R15)

MODEL PAPER – I

MAXIMUM MARKS: 75

PART A **Marks: 25**

All questions in this section are compulsory

Answer in TWO to FOUR sentences.

a) what are the advantages/Disadvantages of open loop system compared to closed loop system?

b) Discuss the effect of feedback on overall gain.

c) Give the expression for the rise time of the step response for second order system.

d) Define transfer function.

e) Define steady state error constants.

f) Discuss merits of robust control.

g) Discuss need for automatic control.

h) Explain the purpose of auto pilot.

i) Discuss the limitation of classical control.

j) What is time invariant linear system

PART B **Marks: 50**

Answer only one question among the two questions in choice.

Each question answer (irrespective of the bits) carries 10M.

Section-I

2 a) Describe a SISO Single input single output) system and a MIMO (Multiple input and multiple output) system and explain how they are analyzed.

b) Describe non- linear system and discuss how they are linearized

OR

3a) Explain the role of feedback in stability augmentation, control augmentation and automatic control with example.

b) Discuss use of transducer, sensor and filter in control system.

Section-II

4a) Find the poles and zeros of a control system whose transfer function is given by

G(s) = (s+3)/ (s^2+7s+12b) With example explain the significance of gain and phase margin

OR

5a) Discuss the significance of corner frequencies, resonant frequencies and peak gain of a second order system

b) Explain the experimental method of determining system transfer function by frequency response measurements.

Section-III

6a) Discuss the functioning of proportional plus derivative control.**?**

b) Discuss the Root Locus method.

OR

7(a) Discuss the purpose and functioning of lead, lag and wash-out filters.

b) Discuss Nyquist criterion.

Section-IV

8a) Discus the relationship between flying qualities and aircraft transfer function

b) Discuss Zeigler and Nicholas method.

OR

9a) Discuss the role of auto-pilot as stability augmenter.

b) Discuss briefly functioning of fly-by-wire control.

Section-V

10a) Define the state variable and state equations with examples.

b) Discuss the properties of state transition matrix

OR

11a) Discuss the significance of Canonical transformation of state equations

b) Discuss the advantages and disadvantages of digital control system.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

(UGC AUTONOUMOUS – Govt. of INDIA)

III B.TECH. II SEMESTER – AERONAUTICAL ENGINEERING

CONTROL THEORY FOR AIRCRAFT (R15)

MODEL PAPER – II

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

All questions in this section are compulsory

Answer in TWO to FOUR sentences.

1a) Define dynamical systems and list its components.

b) Define linear time invariant system.

c) Discuss the relationship between impulse response and transfer function.

d) What do you mean by frequency transfer function?

e) How are the steady state and transient response specified?

f) Discuss the problem with derivative control.

g) Explain the role of rate feedback in stability augmentation system.

h) Differentiate between reversible and irreversible control.

i) Define matrix transfer function.

j) Define controllability.

PART B **Max marks :75**

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

Section-I

2. (a) For a unity feedback system given by G(s) = $\frac{20(s+2)}{s(s+3)(s+4)}$

Find the static error constants & find the steady error for r (t) = 3 u(t).

b) Explain about the standard test signals.

OR

3a) With example explain the method of modelling dynamical systems using differential equations.

b) Discuss modelling and transfer function of i) servomotor ii) actuators.

Section-II

4a) A control system is defined by the following differential equation. Find the output response y (t) using Laplace transform method. Assuming y(t) and dy(t)/dt are zero at t = 0.

$\frac{d2y(t)}{dt2}$ + 7 $\frac{dy(t)}{dt}$ +12 y (t) = u (t); where u t) is unit step unit.

b) Discuss Bode and Polar Plot

OR

5a) Discuss the significance of band width, resonant frequencies, peak gain in relation to second order system.

b) With example discuss the time domain specifications of second order control system.

Section-III

6a) Define and discuss the purpose of gain scheduling.

b) What are the methods of determining the stability of closed loop system

OR

7a) Discuss merits and constraints of non- linear control.

b) Discuss gain and phase margin with suitable examples.

Section-IV

8a) Discuss the flying qualities requirement of an aircraft. What is pilot's opinion rating?**)**

b) Discuss purpose and functioning of pitch, yaw and bank hold auto pilot.

OR

9a) Discuss the role of displacement and rate feedback in the design of stability augmentation system.

b) Discuss the role and purpose of displacement auto-pilot.

Section-V

10(a) What is observability? Explain the tests for observability.

b) Check whether the system represented by

$$\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \\ \dot{x}3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u,$$ is controllable or not.

OR

11. Write the advantages and disadvantages of digital control system over analogue control system.

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III B.TECH. II SEMESTER – AERONAUTICAL ENGINEERING

CONTROL THEORY FOR AIRRAFT (R15)

MODEL PAPER – III

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

i. All questions in this section are compulsory

ii. Answer in TWO to FOUR sentences.

1a) Discuss the merits of open loop system.

b) Discuss the need for a stable system

c) Define and explain transfer function

d) What do you mean by polar plot

e) Define steady state error.

f) Describe the merits and demerits of non -linear system.

g) What do you mean by pilot's opinion rating?

h) Draw the block diagram of a pitch attitude hold auto-pilot.

i) Discuss the significance of canonical transformation.

j) What is matrix transfer function?

PART B **Marks: 50**

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

Section-I

2a) Describe a SISO and MIMO system and explain how they are analyzed.

b) Discuss the importance of studying control system.

OR

3a) Discuss the purpose and functioning of various filters used in control systems.

b) How is overall system stability determined?

Section-II

4a) Discuss the second order system specifications in time domain.

b) Transfer function of a control system is s/((s+1)(s+2)). Find the response for the unit step input.

OR

5a) Write short notes on (i) Gain and phase shift . (ii) Resonant frequency.

b) Describe the relation between transfer function and impulse response.

Section-III

6a) What is compensator? Explain about lead compensator.

b) Discuss the merits and demerits of PID controller.

OR

7a) Write short notes on (i) Gain scheduling (ii) Adaptive control

b) Discuss phase margin and gain margin.

Section-IV

8a) discuss the steps to determine the transfer function of an aircraft.

b) Discuss Zeigler and Nichols method in design of controllers.

OR

9a) Write short notes on reversible and irreversible flight control system.

b) Differentiate between stability control system and control augmentation system.

Section-V

10a) Discuss the method of modelling dynamical system using state space equations.

b) Discuss general form of time invariant linear system.

OR

11a) What is controllability? How do you test the controllability of a system?

b) Discuss the advantages of digital control system over analogue control system

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CONTROL THEORY FOR AIRCRAFTI (R15)

MODEL PAPER – IV

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

All questions in this section are compulsory. Answer in TWO to FOUR sentences.

1. (a) Define dynamical system.

(b) What do you understand by Time invariant linear system?

(c) Briefly discuss impulse and indicial response.

(d) What is the relation between transfer function and impulse response?

(e) Write the properties and application of wash-out filter.

(f) State Nyquist's criterion.

(g) Differentiate between reversible and irreversible control.

(h) Write the purpose of autopilots.

(i) Define state variable and state equation.

(j) Define observability.

PART- B **Maximum Marks: 50**

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

Section-I

2. (a) Discuss deterministic and stochastic control system.

(b) Discuss application of feedback in stability augmentation system

OR

3(a) Discuss merits of feedback control.

(b) Discuss modelling and transfer function of different filters used in aircraft control.

Section-II

4(a) Discuss frequency response method of control system design.

(b) Discuss Bode and Polar plots.

OR

5(a) Discuss the procedure of experimental determination of system transfer functions by frequency response measurements.

(b) Discuss the significance of resonant frequency and bandwidth.

Section-III

6(a) Discuss the application of proportional and integral control.

(b) Discuss implementation, application of adaptive control.

OR

7(a) Discuss the significance and interpretation of gain margin, phase margin.

(b) Discuss frequency response method of analysis and compensation in control system.

Section-IV

8(a) Discuss the response of an aircraft to pilot's control input and atmosphere.

(b) Discuss pole-zero and time-response specifications of flying quality requirements.

OR

9. (a) With help of block diagram explain the functioning and components of a displacement autopilot. (b) Discuss the functioning of normal acceleration command maneuvering autopilot.

Section-V

10.(a) Discuss state space modelling of dynamical system.

(b) Discuss the properties of state –transition matrix.

OR

11. Discuss the process of numerical solution of state equation.

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MODEL PAPER – V

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

All questions in this section are compulsory. Answer in two to four sentences.

1. (a) Discuss sensitivity of output to control input in a feedback control system.

(b) What is the need for a robust control?

(c) Explain the difference between system parameters and characteristic parameters.

(d) What do you understand by gain margin and phase margin?

(e) Define steady state error.

(f) What do you mean by compensation through pole zero cancellation?

(g) What is the purpose of stability augmentation system?

(h) Bring out the purpose of feedback signals in autopilot.

(i) Differentiate between state variable and state equation.

(j) Define controllability.

PART- B **Maximum Marks: 50**

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

Section-I

2(a) Discuss the procedure for analyzing SISO and MIMO system.

(b)Discuss linear and non-linear systems with examples.

OR

3. (a) Discuss the rules and conventions of reducing the block diagram of complex systems.

(b) Discuss the application of feedback control in control augmentation system and automatic systems.

Section-II

4. (a) Discuss the following:

(i) Poles and (ii) Dominant pole.

(b) Discuss the following: (i) Resonant frequency (ii) Peak Gain

OR

5(a) Discuss the purpose of Bode plot.

(b) Solve the following differential equation using Laplace transform.

$\frac{d2y(t)}{dt2}$ + 7 $\frac{dy(t)}{dt}$ +12 y (t) = u (t); where u t) is unit step unit. Assume y (t) and d y (t)/dt is 0 at t = 0.

Section-III

6(a) Discuss steady state and transient specifications of a second order system.

(b) Discuss following type of controllers: (i) Series controller (ii) Feedback controller

OR

7. Discuss frequency response method of determining the stability of a closed loop system.

Section-IV

8(a) Discuss how approximate aircraft transfer function is obtained.

(b) Discuss the role of rate feedback in stability augmentation system.

OR

9 (a) Discuss the purpose and functioning of fly-by-wire system.

(b) Discuss the need for automatic control.

Section-V

10. (a) discuss limitation of classical control theory when applied to MIMO systems.

(b) Explain the general form of linear time invariant system.

OR

11(a) Discuss the significance of Canonical transformation.

(b) Write the advantages and disadvantages of digital control systems.