AIRFRAME STRUCTURAL DESIGN

(R15A4120)

IV B. Tech I Semester

Question Bank

(2017-2018)

Prepared By

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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.

MRCET MISSION

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 Undergraduate 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.

DEPARTMENT OF AERONAUTICAL ENGINEERING

VISION

Department of Aeronautical Engineering aims to be indispensable source in Aeronautical Engineering which has a zeal to provide the value driven platform for the students to acquire knowledge and empower themselves to shoulder higher responsibility in building a strong nation.

MISSION

The primary mission of the department is to promote engineering education and research. To strive consistently to provide quality education, keeping in pace with time and technology. Department passions to integrate the intellectual, spiritual, ethical and social development of the students for shaping them into dynamic engineers.

QUALITY POLICY STATEMENT

Impart up-to-date knowledge to the students in Aeronautical area to make them quality engineers. Make the students experience the applications on quality equipment and tools. Provide systems, resources and training opportunities to achieve continuous improvement. Maintain global standards in education, training and services.

PROGRAM 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 mould 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.

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DEPARTMENT OF AERONAUTICAL ENGINEERING
AIRFRAME STRUCTURAL DESIGN
MODEL PAPER-I

Answer all the questions [25]

1. Discuss with a neat sketch the principal components of a/c [2]
2. Enumerate the types of materials evolved in aircraft manufacturing [3]
3. Discuss the after body loads on the a/c [2]
4 Discuss the difference between doublers and splice with neat sketches [3]
5. Discuss about root rib bulkhead [2]
6. Explain about integrally stiffened panels [3]
7. Explain about kinematic design importance [2]
8. Explain the functions of fuselage [3]
9. Explain the Modes of failure in design phase [2]
10. Discuss about scatter factor and service life [3]

Answer any one from each section 5x10=50

1 Explain with a neat sketch the flight loads acting on the aircraft

(or)

2. Explain the material properties of material used in a/c industry

3. Discuss about shim control and its requirements

(or)

4. Explain with neat sketches the theories of failure with required definitions

5. Explain in detail the principal structural components of wing, discuss about the various arrangements of spars and wing box combinations

(or)

6. Explain in detail the fasteners used in a/c industry

7. Explain the Landing gear functions, arrangement of wheels and gear

(or)

8. Explain the design criteria for forward and aft fuselage
9. Explain the modes of failure discussing the design process for each

(or)

10. Explain about:

service life fatigue life safe life fail safe

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AIRFRAME STRUCTURAL DESIGN
MODEL PAPER-II

Answer all the questions [25]

1. Explain few government regulation bodies in the world [2]
2. Explain the importance of flight envelope on structural design [3]
3. Explain about airplane stiffness data [2]
4 Discuss few points about shim control employed [3]
5. Explain about the bulkheads and pressure bulkhead [2]
6. Discuss about the flap operation mechanism with any one example [3]
7. Explain the oleo-pneumatic shock absorber [2]
8. Explain the visor arrangement for fighter a/c [3]
9. Explain fail safe and safe life [2]
10. Discuss about scatter factor [3]

Answer any one from each section 5x10=50

1 a. Explain the constraint baseline Aerodynamic configuration
b. Discuss the design requirements- certification flow chart, designer's functions, design considerations, engineer functions

(or)

2. Explain about airworthiness requirement and certification bodies for conformity

3. Discuss about the wing loads acting on the a/c by showing the span wise distribution along the wing with neat sketches

(or)

4. Explain about the different types of fasteners employed in a/c design their significance role in maintaining the airframe requirements

5. Explain
Skin stiffened panel Integrally stiffened panel Access holes

(or)

6. Explain the functions of ribs, their types with neat sketches

7. Explain the various types of shock absorbing mechanism used and compare

(or)

8. Discuss the types of engine mount in a/c design
9. Explain the fatigue design philosophy

   (or)

10. Explain about:

    service life fatigue life safe life fail safe plain

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AIRFRAME STRUCTURAL DESIGN
MODEL PAPER-III

Answer all the questions [25]

1. Discuss about durability and damage tolerance [2]
2. Discuss about critical load conditions [3]
3. Explain about gust loads of a/c [2]
4 Explain with neat sketches the types of lugs [3]
5. Discuss the wing box arrangement [2]
6. Explain Leading edges with 3 examples . [3]
7. Explain about spring type of shock absorber [2]
8. Explain the 6 configuration in wing mount [3]
9. Explain GAG graph with stress [2]
10. Discuss about mechanical enviromnet [3]

Answer any one from each section 5x10=50

1 a. Explain the construction of flight envelope used in design of a/c
b. Discuss about margin of safety and factor of safety with required equations
(or)
2. Explain the types of materials used in a/c manufacturing from the Wright flyer to x-15

3. Write short notes on the following loads:
a. Fuselage b. Engine nacelle c. Wing Stores d. control surfaces
(or)
4. Explain about the airplane weight data and stiffness data important for a/c design
b. Discuss landing and taxing loads with neat sketches

5. Explain T.E and L.E surface used in a/c
(or)

6. Explain about wing joints, carry through structure and wing box in detail

7. Explain about various support structures in landing gear and discuss about tires, wheels, brakes
(or)

8. Discuss the design phases for landing gear

9. Explain damage tolerance requirements

(or)

10. Discuss the points focused in structural life estimation

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MODEL PAPER-IV

Answer all the questions [25]

1. Explain structural stiffness and the structural integrity with examples [2]
2. Briefly explain about flight loads [3]
3. Write a short note on damage tolerance [2]
4. Write a short note on margin of safety [3]
5. Write a short note on failure theory [2]
6. Explain briefly about atmospheric maneuver. [3]
7. What are the types of loads falling on wing explain in detail [2]
8. What are fasteners [3]
9. What is the use of fittings [2]
10. Write in detail about types of engine mounts [3]

Answer any one from each section 5x10=50

1. Explain in detail the external loads acting on aircraft with required figures

(or)

2. Explain the terms
   a. safety margin
   b. v-n diagram flap up
   c. factor of safety
   d. JAR
   e. FAR

3.Explain wing loads acting on aircraft with required sketch and equations

(or)

4.Explain different types of fasteners with neat sketches

5. Explain the structural requirements of a wing & wing box.

(or)

6. Explain the terms
   a. Ribs b. spars c. bulkheads d. stringers e. stringer panel

7. Explain the terms with neat sketch

   a. Storage and retraction b. Shock absorbers c. Gear lock

(or)

8. Explain the types of engine mounts used on aircraft
9. Explain the catastrophic effects of fatigue failure in detail.
   (or)
10. Explain the effect of physical and load environment design and the detail fabrication process.

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AIRFRAME STRUCTURAL DESIGN

MODEL PAPER-V

1. Write a short note on catastrophic effects [2]
2. Explain in detail about fatigue failure [3]
3. Give some examples of modes of failure [2]
4. Write a short note on shim control [3]
5. Write the requirements of shim control [2]
6. How will consider the material properties while choosing any design problem [3]
7. What are the mechanical properties we will consider while designing [2]
8. What is safe fail condition [3]
9. Explain the fatigue life of a structural component [2]
10. Give the modes of fatigue failure [3]

Answer any one from each section 5x10=50

1. Explain in detail the principal structural components with neat figure for fuselage

(or)

2. Explain in details about
   a. Aluminum alloys used in aircraft structural design
   b. Wrought forms used in airframe
3. Explain about landing gear types, and its loads

(or)

4. Explain different types of joints possible with neat sketches

5. Explain the leading edge & trailing edge assembly procedure.

(or)

6. Explain the structural design of flaps and ailerons.
7. Explain the structural design of fuselage with neat sketch.

(or)

8. Explain the landing gear design with its internal components and structure.
9. Explain about fail safe and safe life features in fatigue design.

(or)

10. Explain the terms
    a. Fatigue strength b. Scatter factor c. damage tolerance

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IV-B.TECH – I SEMESTER AERONAUTICAL ENGINEERING

AIRCRAFT MAINTENANCE ENGINEERING (R15A2125)

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.

a) Define Maintenance	(3)
b) Mention two types of maintenance	(2)
c) Define type certificate	(3)
d) Give a summary of FAA requirements	(2)
e) Draw a neat of organizational chart for technical services	(3)
f) Explain in brief about "A" check planning	(2)
g) What is meant by line maintenance	(3)
h) Write contents of Airframe log book	(2)
i) What are the types of reliability	(2)
j) Define Quality Assurance	(3)

PART B **Max Marks: 50**

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

2. Explain failure rate pattern with a neat sketch [10]

OR

3. Explain maintenance steering group (MSG) approach in steps in aircraft maintenance management with the help of line diagram [10]

4. Explain Manager level Functions of aircraft maintenance [10]

OR

5. Explain about additional maintenance program requirements [10]

6. Explain about organization of PP&C [10]

OR

7. Explain functions of engineering department in tech service. [10]

8. explain about the functions that control maintenance and MCC responsibilities [10]

OR

9. What are the problem areas of hangar maintenance? Brief about operation of overhaul shops [10]

10. Explain about ground support equipment (GSE) in hangar maintenance of aircraft [10]

OR

11. Explain about basic inspection policies in aircraft management [10]

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IVB.TECH – I SEMESTER AERONAUTICAL ENGINEERING

AIRCRAFT MAINTENANCE ENGINEERING (R15A2125)

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.

a) Outline any two maintenance objectives (2)
b) Define OC activity (3)
c) Write ant two FAA requirements (2)
d) Mention any maintenance tasks for aircraft systems (3)
e) Write any two differences of Engineer & Mechanics in their role (2)
f) State any two functions of MCC (3)
g) Mention contents of engine log book (2)
h) Differentiate between line & hangar maintenance (3)
i) Define Quality Control (3)
J) Define quality audits (2)

PART B **Max Marks: 50**

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

2. List out differences between intra flight (TRS) & last flight servicing [10]

OR

3. Explain maintenance program documents [10]

4. Explain task oriented maintenance approach [10]

OR

5. Explain about the types of aviation certificate with neat sketches [10]

6. Explain about production control & feedback for planning [10]

OR

7. Explain about multiple checks in production planning [10]

8. What are the functions of material directorate [10]

OR

9. Discuss about fault isolation and fault report manual [10]

10. What are the elements of reliability program? Explain in brief about safety regulation [10]

OR

11. Explain about maintenance safety program, general safety rules [10]

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IVB.TECH – I SEMESTER AERONAUTICAL ENGINEERING

AIRCRAFT MAINTENANCE ENGINEERING (R15A2125)

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.

a) Write goals of maintenance (3)
b) Define Condition monitoring process (2)
c) Define task cards (3)
d) Explain the outline of aviation maintenance program (3)
e) State two functions of technical service directorate (2)
f) Define controlled documents (2)
g) State line station activity (3)
h) Write any two functions of material directorate. (2)
i) What are general safety rules (3)
j) Explain about ramp operations (2)

PART B **Max Marks: 50**

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

2. Explain role of an engineer of aircraft maintenance. [10]

OR

3. Explain role of mechanic in aircraft maintenance and MSG approach [10]

4. Explain steps in detail about airline generated documentation .[10]

OR

5. Explain in detail about functions of technical publications [10]

6. Explain about the airframe manufacturers training course and airline maintenance training [10]

OR

7. Explain about requirement of Quality Assurance [10]

8. Explain about makeup of line maintenance [10]

OR

9. Write functions of MCC [10]

10. What are the elements of reliability program? Explain in brief about safety regulation [10]

OR

11. Write short notes on [10]
    a) FAA and JAA QC inspector
    b) general safety rules
    .

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IVB.TECH – I SEMESTER AERONAUTICAL ENGINEERING

AIRCRAFT MAINTENANCE ENGINEERING (R15A2125)

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.

a) Define reliability (2)
b) Write goals of maintenance (3)
c) Draw a neat sketch of M&E organization chart (2)
d) What is aircraft maintenance (3)
e) Define engineering order (2)
f) Draw organization chart of technical services directorate (3)
g) Define Quality control (2)
h) What do you understand by Ground service equipments (3)
i) Define elements of reliability program (2)
j) Define nondestructive test and inspection (3)

PART B **Max Marks: 50**

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

2. Explain about establishing a maintenance program. [10]

OR

3. Explain MSG-3 level –I analysis failure category approach [10]

4. Explain the managerial functions of overhaul shops directorate. [10]

OR

5. Explain about overhaul shop operations [10]

OR

6. Explain the role of Production planning & control in maintenance Management [10]

7. Explain technical training organization [10]

8. Explain about makeup of line maintenance. [10]

OR

9. Explain about Maintenance Control Center responsibilities. [10]

10. Explain about requirement of Quality assurance. [10]

OR

11. Write short notes on [10]
    a)Statistical reliability
    b)Dispatch reliability.

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IVB.TECH – I SEMESTER AERONAUTICAL ENGINEERING

AIRCRAFT MAINTENANCE ENGINEERING (R15A2125)

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.

a) Define redesign (2)
b) State two failure pattern (3)
c) Define HT activity (2)
d) Define Zonal maintenance task (3)
e) Define engineering order (2)
f) Draw organization chart of technical services directorate (3)
g) Define management and DOM (2)
h) Explain ramp and terminal operations (3)
i) Define quality assurance (2)
j) State any two QC inspector qualifications (3)

PART B **Max Marks: 50**

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

2. Explain goals & objectives of maintenance [10]

OR

3. Discuss concept of reliability and redesign in context of maintenance [10]

4. Explain maintenance task for airframe systems in task oriented maintenance [10]

OR

5. Explain 'A' check and 'C' check planning in aircraft hangar maintenance [10]

6. Explain manager level functions in technical services directorate and outline of aviation maintenance program [10]

OR

7. Explain about maintenance planning document [10]

8. Explain about hangar maintenance activity – A typical "C" check up [10]

OR

9. Explain about overhaul non-routine parts, parts availability & saga of parts robbing [10]

10. Explain about organization structure &TPPM [10]

OR

11. Explain about ISO-9000 quality standards in aircraft maintenance management [10]

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IV B.TECH. I SEMESTER – AERONAUTICAL ENGINEERING

AVIONICS (R15)

MODEL PAPER – I

Time: 3 Hours **Max marks: 75**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B contains of 5 units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART –A (25 Marks)

1. (a) Enumerate core avionics systems in modern aircraft. (3)

(b) List few aircraft state sensors. (2)

(c) List components of Head-up display (HUD). (3)

(d) List the limitations of VHF communications against HF Communication system. (2)

(e) Draw a neat block diagram of a ring laser gyro illustrating various parts. (3)

(f) List the errors in inertial systems. (2)

(g) Illustrate the purpose of VHF Omni-range and distance measuring equipment. (3)

(h) How is the inertial navigation system aligned? (2)

(i) Explain the principle of autopilot. (3)

(j) Explain the purpose of flight management system. (2)

PART- B

2. (a) Discuss the importance and role of Avionics in modern aircraft.

(b) Illustrate the function of ARINC and MIL-STD-1553 B data bus.

OR

3. (a) Explain the method for protecting avionics systems against environmental conditions.

(b) Differentiate between electrical and optical data bus system.

4. (a) Discuss the solid state standby display systems.

(b) Explain Head down displays in military fighter aircraft cockpit.

OR

5. (a) With the help of a neat diagram, explain the principle of radio voice communication.

(b) Explain the principle of satellite communications.

6. (a) Explain the principle of mechanical gyroscopes.

(b) Explain the functioning of differential global positioning system.

OR

7. (a) Explain the functioning of spring restrained pendulous accelerometers.

(b) Explain the requirement and process of integration of GPS and INS.

8. (a) Discuss the principle of strap-down inertial navigation system.

(b) With neat diagram explain the purpose and functioning of attitude and heading reference system.

OR

9. (a) Explain the purpose and functioning of Kalman filters.

(b) Explain the functioning of automatic direction finders in an aircraft.

10. Write short notes on.

(a) Traffic collision and avoidance system (TCAS)

(b) Enhanced ground proximity warning system (EGPWS)

OR

11. Explain the principle of following auto pilot.

(a) Height control (b) Heading control.

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IV B.TECH. I SEMESTER – AERONAUTICAL ENGINEERING

AVIONICS (R15)

MODEL PAPER – II

Time: 3 Hours **Max marks: 75**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B contains of 5 units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART –A

1. (a) Enumerate various outside world sensors. (2)

(b) List the purpose and method of avionics packaging. (3)

(c) List the purpose of helmet mounted display. (2)

(d) List the various head down displays in fighter aircraft. (3)

(e) Explain the basic principle of accelerometer as sensor. (2)

(f) Differentiate between strap-up and strap-down inertial navigation system. (3)

(g) What do you mean by gyro compassing with respect to inertial navigation system? (2)

(h) Discuss the functioning of localizer with a diagram in landing system. (3)

(i) Discuss the role of Mode S transponder. (3)

(j) Explain the purpose of ILS coupled autopilot control. (2)

PART-B

2 Explain the requirement of Avionics equipment and systems with respect to

(i) Environment

(ii) Reliability

OR

3 (a) Discuss how various avionics systems are interfaced with the pilot.

(b) Discuss the functioning of MIL-STD-1553B data bus.

4. (a) Discuss intelligent display management systems in modern aircraft.

(b) Explain the functioning of data recorder systems in an aircraft.

OR

5. (a) Explain ACARS data communication systems.

(b) Write short notes on

(i) Audio management system

(ii) In-flight entertainment system

6 (a) Explain the functioning of micro machined vibrating mass rate gyro.

(b) Discuss the principle and functioning of torque balancer pendulous accelerometer.

OR

7. With the help of neat diagram explain the principle and various segments of a global positioning system.

8. (a) Discuss the principle and components of Radio-navigation system.

(b) How are the angular rate and acceleration corrections provided in inertial navigation system?

OR

9(a) Explain the principle of strap-down INS computing.

(b) Explain the functioning of glide-slope and marker systems in ILS.

10. (a) Discuss the principle of weather radar systems.

(b) How is auto-stabilization achieved in an aircraft?

OR

11. (a) Explain the functioning of speed control and auto throttle control systems.

(b) Write short note on flight management system.

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IV B.TECH. I SEMESTER – AERONAUTICAL ENGINEERING

AVIONICS (R15)

MODEL PAPER – III

Time: 3 Hours **Max marks: 75**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B contains of 5 units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART –A (25 Marks)

1. (a) Enumerate core avionics systems. (3)

(b) What are the reliability requirements of avionics system? (2)

(c) List the components of head tracking system. (3)

(d) What is the purpose and meaning of data fusion in displays? (2)

(e) List the basic principles of gyroscope. (3)

(f) What is the purpose of integration of INS with GPS? (2)

(g) How is INS aligned? (3)

(h) List the categories of Instrument landing systems. (2)

(i) Enumerate the functioning of air traffic control systems. (3)

(j) Draw the block diagram of speed control system. (2)

PART-B

2. (a) Explain the purpose and functioning of electrical data bus systems.

(b) What are the various task automation systems? How do they function?

OR

3. (a) Discuss briefly ARINC specifications.

   (b) Write short note on avionics packaging.

4. (a) Explain the display systems in modern military aircraft.

   (b) Discuss the functioning of helmet mounted displays.

OR

5. (a) With neat diagram explain the functioning of data communication system.

   (b) Discuss the role and functioning of audio management system in a modern civil aircraft.

6. (a) Discuss the principle of ring laser gyro with the help of a diagram.

   (b) Discuss the purpose and functioning of differential GPS.

OR

7. (a) Write short note on augmented satellite navigation system.

   (b) What are the sources of errors in inertial systems? Explain.

8. (a) Explain the purpose and operation of attitude and heading reference system.

   (b) How is angular rate correction done in inertial system?

OR

9. Explain the principle of instrument landing system including localizer, glide slope and marker systems.

10. (a) Explain the operation of airborne weather warning radar system and associated display.

    (b) Discuss the purpose and functioning of stability augmentation system.

OR

11. (a) Explain the principle and operation of height hold autopilot with the help of neat diagram.

    (b) How is the response of an aircraft determined due to longitudinal control? Briefly explain.

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IV B.TECH. I SEMESTER – AERONAUTICAL ENGINEERING

AVIONICS (R15)

Time: 3 Hours **Max marks: 75**

MODEL QUESTION PAPER- IV

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B contains of 5 units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART –A

1. (a) List core avionics systems. (2)

(b) What are the main types of dead reckoning navigation systems? (3)

(c) List the main advantages of head-up display in civil aircraft. (3)

(d) Draw the block diagram of an intelligent display management system. (2)

(e) Elaborate multi-path error in GPS. (2)

(f) Discuss the requirement of integration of INS and GPS. (3)

(g) List various range and bearing radio navigation aids. (3)

(h) What are the various angular rate correction terms? (2)

(i) Write the purpose of stability augmentation system. (2)

(j) List the functions performed by flight management system. (3)

PART-B

2. (a) Discuss various task automation systems in modern aircraft.

(b) Briefly explain electrical data bus systems.

OR

3. (a) Discuss integrated avionics system architecture in a civil aircraft.

(b) Discuss environment and reliability requirements of avionics equipment.

4. (a) Briefly explain the working of head tracking systems.

(b) Discuss the functions of solid state standby display systems.

OR

5. (a) Discuss the components of voice communication systems in an aircraft.

(b) Explain the functioning and purpose of data recorder systems in an aircraft.

6. (a) Explain the principle of micro electro-mechanical systems (MEMS) technology rate gyros.

(b) Explain the functioning of simple spring restrained pendulous accelerometer.

OR

7. (a) Write short notes on

(i) Differential GPS

(ii) Augmented satellite navigation systems.

(b) Discuss various errors in inertial systems.

8. (a) Discuss the basic principle and attributes of inertial navigation.

(b) Discuss the effect of accelerometer bias and Gyro drift on the errors in inertial navigation system.

OR

9. Explain the functioning of aided INS and Kalman filters.

10. (a) Discuss the purpose and functioning of speed control and auto-throttle systems.

(b) Explain how performance prediction and flight path optimization is achieved.

OR

11. (a) Discuss the purpose and process of flight planning.

(b) Discuss how a coordinated turn is achieved in an aircraft. Derive the necessary relation between bank angle, rate of turn and aircraft velocity.

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IV B.TECH. I SEMESTER – AERONAUTICAL ENGINEERING

AVIONICS (R15)

Time: 3 Hours **Max marks: 75**

MODEL QUESTION PAPER- V

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B contains of 5 units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART –A (25 Marks)

1. (a) List various aircraft state sensors. (2)

(b) List the task performed by flight management system. (3)

(c) Write the advantages of HF communication systems. (2)

(d) What are the components of HUD electronics? (3)

(e) Explain the purpose of gyro and accelerometer in inertial system. (3)

(f) What is the purpose of INS and GPS integration? (2)

(g) Explain the purpose of initial alignment in INS. (3)

(h) Explain the purpose of markers in instrument landing system. (2)

(i) Write the purpose of mode S transponder. (3)

(j) Draw the block diagram of a height control autopilot. (2)

PART-B

2. Discuss the requirements of avionics equipment with respect to following:

(i) Environment (ii) Weight (iii) Reliability.

OR

3. Discuss the purpose and functioning of various data bus systems in civil and military aircraft.

4. Write short notes on

(i) Data fusion in displays.

(ii) Head down displays in military cockpit.

OR

5. Write short notes on

(i) In-flight entertainment system

(ii) ACARS data communication system.

6.(a) Explain the functioning and components of global positioning system.

(b) Explain the functioning of differential GPS.

OR

7. Explain various errors and their compensation methods in inertial navigation systems.

8. Write short notes on

(i) VHF omni-range (ii) Distance measuring equipment (iii) Automatic direction finding.

OR

9. Explain the function of instrument landing system including localizer, glide slope and marker beacons.

10. Write short notes on

(i) TCAS (ii) EGPWS

OR

11. Discuss in detail longitudinal and lateral control and response of aircraft.

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IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
COMPUTATIONAL AERODYNAMICS - II (R15A2119)
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. What is CFD? Explain CFD as research and design tool.
2. What is characteristic line and explain its importance in finding behaviour of PDE's.
3. What is the significance of eigen values and how they classify the behaviour of PDE's.
4. Discuss pros and cons of higher order finite differences.
5. What is difference equation and write for Laplace equation.
6. Define Grid and its need for CFD.
7. Explain the nomenclature of 2D and 3D grid.
8. Explain about upwind scheme on Cartesian grid.
9. What is predictor step?
10. What are over-relaxation and under-relaxation factors?

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. Derive the continuity equation for a control volume moving with fluid and transform it to other models with neat diagram.

(OR)

2. Derive the equation for Substantial derivative with neat sketch.
3. Explain the procedure to find the mathematical behaviour of partial differential equation using cramers rule method with an example of linearized velocity potential equation for subsonic and supersonic case and its effect on CFD?

(OR)

4. Give the classification of Partial Differential Equations, explaining the characteristics of each type of PDE.
5. Derive finite difference schemes for the following partial differential equations and indicate their order of accuracy:
   (i) $(\partial u/\partial t) + a\,(\partial u / \partial x) = 0$.
   (ii) $(\partial u/\partial t) = a\,(\partial^2 u / \partial x^2)$.
   (iii) $(\partial^2 u / \partial x^2) + (\partial^2 u / \partial y^2) = 0$.

(OR)

6. Using the Taylor's series approximation, derive the finite difference expressions for first order and second order differential terms of variable, Φ.
7. Discuss difference between structured and unstructured grid. Write short note on the following types of grids with neat sketches:

a) Adaptive grids b) Stretched grids c) Overset grids

(OR)

8. Explain cell-centered and cell-vertex discretization methodologies with their constraints in selection. Discuss general formulation of a numerical scheme for 2D problem based on finite volume method.
9. Explain MacCormack's explicit finite difference technique and discuss its advantage over Lax-Wendroff method.

(OR)

10. Describe the philosophy of Pressure Correction technique. Explain how boundary conditions are specified consistent with the philosophy of Pressure Correction method.

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IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
COMPUTATIONAL AERODYNAMICS - II (R15A2119)
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 applications of CFD in various engineering sciences.
2. Write a short on CFD approach to solve parabolic form of equations with example.
3. Write a short on CFD approach to solve hyperbolic form of equations with example.
4. Write a short note on supersonic flow over blunt body.
5. Write the various forms of finite differences for first and second derivatives?
6. What are the different types of boundary approximations can be done for curved boundaries to accommodate Cartesian grid.
7. What is the difference between FVM and FDM.
8. Why FVM is also known as Conservative Discretization.
9. What is checker board velocity distribution?
10. What is the need of staggered grid for pressure correction technique?

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. Derive the energy equation for infinitesimal moving fluid element with neat sketch.

(OR)

2. (a) Discuss the relative merits and demerits of analytical, experimental and computational approaches in the analysis of fluid flows. Discuss the steps involved in CFD process.
   (b) Explain various methods of calculation of flows with shocks. Discuss their relative merits and demerits.
3. Explain the procedure to find the mathematical behaviour of partial differential equation using Eigen value method with an example of linearized velocity potential equation for subsonic and supersonic case and its effect on CFD?

(OR)

4. Discuss the mathematical and physical behavior of flows governed by parabolic equations with an example of boundary layer flows.
5. Derive the stability condition for CTCS discretization of second order wave equation using von Neumann stability analysis.

(OR)

6. Obtain the CFL condition for Lax method of discretization of first order wave equation.
7. Explain about importance of numerical aspects of dissipation and dispersion with artificial viscosity.

(OR)

8. Explain Crank-Nicolson implicit scheme used for solving the parabolic partial differential equations
9. Explain PISO algorithm for solving incompressible viscous flow problems.

(OR)

10. Derive Pressure Correction formula considering two dimensional flows and explain step by step procedure for SIMPLE algorithm.

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IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
COMPUTATIONAL AERODYNAMICS - II (R15A2119)
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. Write a brief note on different type of fluid models.
2. Differentiate conservative and nonconservative form of governing equations and its impact on CFD.
3. Write a short on CFD approach to solve elliptic form of equations with example.
4. What is meant by discretization and finite difference method?
5. What is CFL condition?
6. What are Stretched / Compressed Grid?
7. What are I, H, C-H, H – O – H Meshes.
8. What is artificial viscosity?
9. What are the advantages of two step CFD Techniques.
10. Why compressible flow code takes longer time to converge incompressible flow problems.

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 physical meaning of Divergence of velocity and derive the equation with neat sketch.

(OR)

2. Derive the x-momentum equation for an infinitesimal moving fluid element with neat diagram.
3. For one dimensional heat conduction equation:
   (a)Obtain discretized form of finite difference quotient.
   (b) Using explicit method, write algebraic equations for 4 X 4 grid.
   (c) Explain any numerical method to obtain solution for temperatures.

(OR)

4. How do you determine the accuracy of the discretization process? What are the uses and difficulties of approximating the derivatives with higher order finite difference schemes? How do you overcome these difficulties?

5. Discuss briefly about multiblock and non conformal grids with neat sketches with applications.

(OR)

6. Write the basic procedure of Finite Volume Discretization and difference between FDM and FVM?

7. Discuss ADI method for solving parabolic problems with an example and neat sketches.

(OR)

8. Describe how relaxation method is more superior in solving the elliptical partial differential with an example.
9. Describe the calculation of the flow field of incompressible viscous fluids Using SIMPLE algorithm writing down the important steps. Draw the staggered grid indicating the physical parameters used in this algorithm.

(OR)

10. Describe SIMPLER pressure correction technique for an incompressible viscous flow and compare it with SIMPLE technique.

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IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
COMPUTATIONAL AERODYNAMICS - II (R15A2119)
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 the physical meaning of substantial derivative and divergence of velocity.
2. What is the difference between differential and integral form of equations with its effect on CFD.
3. What are different types of errors and stability of solution?
4. Why first order wave equation is unconditionally unstable with FTCS scheme?
5. How did boundary nodes are calculated with higher order accuracy.
6. Write short note on triangular, tetrahedron, quadrilateral, hexahedron and hybrid cells.
7. Write procedure to solve 1D problem using FVM.
8. What is Cell-averaged method?
9. Write a short note on various types of flux evaluations across surfaces.
10. What is meant by CFD Technique?

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 concepts of domain of dependence and range of influence as applicable to the solution of hyperbolic equations and elliptic equations with neat sketches and its impact on CFD.

(OR)

2. What is the need for classification of PDE and how do you classify second orderPDE?
3. Explain Von Neumann stability analysis for first and second order wave equations in detail with a neat sketch.

(OR)

4. Given the function $f(x) = x^3-5x$, calculate $\partial f/\partial x$, $\partial^2 f/\partial x^2$, at x=0.5 and 1.5 by using second order central, forward and backward differencing. Using step sizes 0.00001, 0.0001, 0.01, 0.2, 0.3 determine numerical error for each computation.

5. Explain C-H, H-O-H, O-H grid topologies with sketches along with their applications.

(OR)

6. Explain suitable grid for moving body problems and grid quality parameters with neat sketches.
7. Explain the two-dimensional finite volume method and describe evaluation of fluxes through cell surfaces using central discretization schemes

(OR)

8. Define finite volume discretization and explain the features which distinguish the interpretation of finite volume methods from the finite difference approach
9. Explain how the concepts of numerical dissipation and artificial viscosity are used to stabilize and smoothen numerical solutions.

(OR)

10. Explain the CFD Technique to solve the conservation form of viscous flow governing equations for unsteady problem.

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IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
COMPUTATIONAL AERODYNAMICS - II (R15A2119)
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. How CFD is helpful as a research tool, a design tool, and an educational tool in analyzing fluid dynamical problems
2. Discuss how Computational Fluid Dynamics is vital in the following fields Automobile engineering and Industrial manufacturing.
3. Discuss with a neat diagram shock capturing method along with its merits and demerits
4. Write down the most generic form of a partial differential equation used in CFD and explain the significance of each term
5. Explain different type of methods to classify the partial differential equations.
6. What is the difference between Implicit and Explicit methods?
7. When Cartesian grids are appropriate to use and what are its advantages.
8. Why Finite volume method is suitable for Fluid dynamic problems.
9. Explain the importance of single step and double step CFD techniques.
10. Write a short note on difference between SIMPLE and SIMPLEC algorithms.

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 about difference between analytical, experimental and computational study of fluid dynamics. Explain the impact of CFD in present research fields with an example.

(OR)

2. Explain the importance of various forms of fluid models with neat sketches and when do we use respective models to derive governing equations of fluid flow. How do these models effect CFD methodology.
3. A two-dimensional small-disturbance velocity potential equation for compressible flows is given as $(1 - M_\infty^2)\frac{\partial^2 \emptyset}{\partial x^2} + \frac{\partial^2 \emptyset}{\partial y^2}$, where M is the Mach number of flow.
   (i) Examine whether this equation is parabolic, elliptic, or hyperbolic?
   (ii) Justify your inference from pure physical arguments.

(OR)

4. Identify the nature of the following systems of partial differential equations:

   $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y} = v$where u and v are the two dependent variables.

5. What are the types of discretization techniques and their advantages over other? Explain the discretization of higher order derivatives and how to increase its accuracy.

(OR)

6. Explain the two-dimensional finite volume method and describe evaluation of fluxes through cell surfaces using central discretization schemes and how to evaluate areas of volumes with neat sketches.
7. (a) Compare all the three different types of Implicit, Explicit methods of solving unsteady state conduction problems and discuss the problems associated with these methods.
   (**b)** Why stability criteria need to be satisfied for the explicit method of solving the transient equation? Explain

(OR)

8. Describe a relaxation method for solving the elliptical partial differential
9. Describe SIMPLER pressure correction technique for an incompressible viscous flow and compare it with SIMPLE technique.

(OR)

10. Explain PISO algorithm for solving incompressible viscous flow problems and its advantages over SIMPLE and SIMPLEC algorithms

IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
CAD/CAM
MODEL PAPER -1
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

Note: A**nswer <u>All</u> the following questions**

1. Give the general configuration of a CAD computer system.
2. What is the structure of a computing system?
3. What are the types of surfaces that CAD/CAM systems use?
4. What are the limitations in utilizing the sweep method for geometric construction?
5. Describe the features of CNC machining centers.
6. Differentiate between CNC and DNC machining. .
7. List the different types of Practical NC machines
8. List three advantages of G.T.?
9. What are the objectives of CAQC
10. What is computer integrated manufacturing

PART B **Max Marks: 50**

Note: Answer any *<u>FIVE</u>* questions choosing at least one from each Unit

1. (i). In design, what do you understand by synthesis and engineering analysis?
   (ii). Explain how CAD helps to synthesize a product design and do engineering analysis for getting optimal design.

(OR)

2. (i) Write on the importance of studying geometric modeling in CAD.
(ii).What are entities? Explain the methods of defining lines, arcs and Circles in wire frame modeling

3. (i). How do you ensure convex hull property in Bezier surface?
(ii). Describe the effect of characteristic polyhedron over the resulting Bezier surface.

.

(OR)

4. . Explain how the surfaces are represented in
   i. Generic form
   ii. Parametric form.
5. (i) Describe the axis representation system used for CNC Milling machines.
   (ii) Discuss the various interpolation methods used in NC machines.

(OR)

6. Discuss the special features of NC machine tool when compared to the conventional machine tools

7 (i). Explain Opitz classification system.
(ii). Discuss the basic code structures used in group technology.

(OR)

8 What are the objectives of CAQC? Explain the different computer aided inspection methods

9 Explain the concept of FMS with a typical sketch describing its components

(OR)

10 Discuss the possible computer applications in Manufacturing Planning activities.

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IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING
CAD/CAM
MODEL PAPER -2
MAXIMUM MARKS: 75

PART A **Max Marks: 25**

Note: A**nswer All the following questions**

1 In what ways CAD can help manufacturing activity? Discuss.
2 What is the structure of a computing system?
3 What do you mean by blending function
4 What are the advantages of Bezier surface over B- spline surface
5 Differentiate between horizontal and vertical flow patterns giving its utility.
6 Discuss the several word functions in Numerical Control systems.
7 Write the steps involved in Production flow analysis
8 Define the term "Group Technology" and its importance .
9 What is computer integrated manufacturing? Explain
10 How does CIM integrate all activities of industry? Explain

PART B **Max Marks: 50**

Note: Answer any *FIVE* questions choosing at least one from each Unit

1 (i). What are the functions of an interactive graphic design workstation?
(ii). Explain with the help of a neat sketch, how an image is generated on a computer terminal.

(OR)

2 What do you understand by the form element method of geometric construction? Specify the applications of this method of modeling in comparison to that of the variant type.

3 Differentiate between Bezier and B- spline surface with reference to number of control points, order of continuity and surface normal

(OR)

4 Specify the three principal classifications of the geometric modeling systems and write in brief about each of them.

5 Draw the Manual Part Programming sheet and explain how the entries are made in the sheet with the help of an example

(OR)

6 (i). What is adaptive control system? Discuss its advantages to the manufacturing technology.
(ii). Discuss the merits and demerits of NC and DNC system

7 (i). What are the advantages of CAPP over Manual process planning? Explain in detail.
(ii). Explain machine cell design in group technology.

(OR)

8 Compare a process-type layout and group technology layout for batch production of a simple component

9 FMS is applied In which type of production? What are the advantages of FMS?

(OR)

10 Explain with the aid of a block diagram the “concept of CIM”

IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

CAD/CAM

MODEL PAPER -3

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

Note: A**nswer All the following questions**

1. Discuss the Wire frame entities.
2. Identify the types of printers that would be useful for printing graphic information.
3. What do you mean by blending function ?
4. Define composite surface and Bezier surface.
5. List out the different numerical control elements.
6. Write the principal of operation of a NC machine tool.
7. Define Part family in Group Technology
8. List out the different types of CAPP
9. State the working principle of a Flexible Manufacturing System.
10. Define CIM as per SME

PART B **Max Marks: 50**

Note: Answer any *FIVE* questions choosing at least one from each Unit

1. a) Explain the Graphical Terminal CAD Software.
   b) Derive the cubic spline equations

(OR)

2. What is a product life cycle? Explain in detail about the conventional manufacturing product life cycle and CAD/CAM product life cycle.
3. Describe the following with reference to a surface patch
   a) Subdividing
   b) Regenerative surface

(OR)

4. Describe the scheme of boundary representation to create solid models of physical objects
5. Discuss briefly the following NC motion control systems.
   i. Point -to-point
   ii. Straight cut
   iii. Contouring

(OR)

6. (a) Differentiate between
   (i)Absolute and Incremental positioning system
   (ii)Fixed and Floating zero method
   (b) Differentiate between
   (i) NC, CNC and DNC system

7. a) Explain guidelines and benefits of Group Technology
   b) Discuss the advantages of CAPP over Manual process planning

(OR)

8. a) Explain machinability data system with respect to group technology
   b) Explain briefly the MICLASS system of codification
9. how does CIM integrate all activities of industry ? explain.

OR

10. a) Describe a material handling system
    b) Discuss the objectives of CAQC. Explain the different computer aided inspection methods

IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

CAD/CAM

MODEL PAPER -4

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

Note: A**nswer All the following questions**

1. What are the various data base models
2. What are the output devices used in CAD system
3. Explain how a B-spline surface is defined
4. Define cell composition
5. What are the coordinate system used in NC system
6. Discuss the principle functions of DNC system
7. What are the steps involved in production flow analysis
8. What is material resource planning
9. What are the objectives of CAQC
10. Define generative process planning

PART B **Max Marks: 50**

Note: Answer any *FIVE* questions choosing at least one from each Unit

1. (i) justify the need for CAD in present competitive market environment
   (ii) list out the benefits of CAD/CAM

   OR
2. (i) what is the basic structure of CAD explain
   (ii) Define geometric model?explain how a 3-D objective is represented by a wireframe model
3. Explain about regenerative surface with an example

   (OR)
4. Differentiate between solid modeling and wireframe modeling

5. (i) Write the part program to drill the holes in the part shown in the figure .The part is 12mm in thick. Cutting speed =100mm/min and fed= 0.06mm/rev. Use the lower left corner of the part as the origin in the X-Y axis system. write the NC part program. Use the absolute positioning. All dimensions are given in mm

   (ii) Explain the APT statements (a) GOTO and GO/TO (b) GODLTA and GOBACK (c) INTOL and OUTTOL.

(OR)

6. (i) Discuss the difficulties encountered in using conventional numerical control
   (ii)Enumerate the advantages of computer Assisted part programming when compared to manual part programming.
7. (i) Explain the retrieval type process planning system with the help of a block diagram
   (ii) Explain the concept of composite part with an example.

(OR)

8. Explain indetail about computer Aided manufacturing and resource planning
   (ii) Write a short notes on capacity requirements planning.
9. Distinguish between CIM and CAD/CAM

OR

10. Describe the material handling system in detail.

IV B.TECH I SEMESTER – AERONAUTICAL ENGINEERING

CAD/CAM

MODEL PAPER – 5

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

Note: A**nswer <u>All</u> the following questions**

1. Identify the types of printers that would be useful for printing graphic information
2. Define i) Free form surface ii) Planar surface
3. List the different types of industrial manufacturing
4. List the different types of curves.
5. State the purpose of a tool pre-setter.
6. What are the components of DNC system.
7. What are general methods for grouping parts into families
8. What is process planning?
9. Define C-Chart and P-Chart.
10. Differentiate between inspection and testing

<u>PART B</u> **Max Marks: 50**

Note: Answer any *<u>FIVE</u>* questions choosing at least one from each Unit

1. (i) Explain the Graphical Terminal CAD Software
   (ii) Derive the cubic spline equations.

   (OR)
2. Explain different curve fitting techniques in geometric modeling.
3. Discuss the limitations in utilizing the sweep method for geometric construction

   (OR)
4. Write short notes on
   (i) NURBS
   (ii) B-splines.
5. (i) What are the preparatory functions for turning part programming
   (ii) what are the different methods of manual part programming? Explain.

   (OR)
6. Explain the steps in APT and also Explain the G codes used for tool offset functions
7. Explain machine cell design in group technology. Compare a process-type layout and group technology layout for batch production of a simple component

   (OR)

8. Justify the requirement of CAQC in current advanced manufacturing
9. (i) Explain the SME manufacturing enterprise wheel.

   (ii) Explain the applications of CIMS

(OR)

10. Describe a materials handling system. Explain the three major elements of an ASRS

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AERONAUTICAL ENGINEERING

MECHANICAL VIBRATION AND STRUCTURAL DYNAMICS

MODEL PAPER-I(R15)

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

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

1. Find mass W, if the system has a natural frequency of 10 Hz shown in fig.1. Take K_1 = 2 N/mm, K_2 = 1.5 N/mm, K_3 = 3 N/mm and K_4 = K_5 = 1.5 N/mm. [3]

2. What is vibration; write short notes on importance of vibration. [2]

3. What is meant by vibration isolation and transmissibility [3]

4. Derive the expression for natural frequency of undamped 2 DOF torsional vibration system. [3]

5. Write shortnotes on vibration isolation
   [2]

6. What is meant by coordinate coupling explain briefly
   [2]

7. Define (1) Fundamental frequency(2) Critical damping co-efficient (3) Time period
   [3]

8. Explain briefly about Frahm's read Tachometer with near sketch.
   [2]

9. What is meant by Eigenvalue and Eigenvector and explain with respect to vibration with an example.
   [3]

10. Write short notes about self-excitation and stability analysis
    [2]

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 weight attached to a spring of stiffness 625 N/m has a viscous damping device. When the weight is displaced and released, the period of vibration is found to be 2 seconds, and the ratio of consecutive amplitudes is 4 to 1. Determine the amplitude and phase when a Force F(t) = 20 Cos(5t) acts on the system [10]

OR

12. An unknown mass 'm' kg attached at the end of an unknown spring 'k' has a natural frequency of 100 cpm when 0.5 kg mass is added to 'm', the natural frequency is altered by 25% Determine the unknowns 'm' and 'k' ? ii) A spring mass system has a natural frequency of 10 rad/sec. The mass is pulled down from its static equilibrium position by 5 mm and given an upward velocity of 10 cm/sec, determine the ensuing motion. [10]

13. In a spring mass damper system the amplitude decays to half the original value in 4 oscillations and it takes 0.2 seconds to complete these oscillations. If the mass is set in

to free vibrations with an initial displacement of 5 mm and initial velocity of 0.5 m/sec, determine i) the subsequent motion ii) maximum amplitude of the mass iii) Time elapsed while the amplitude decays to less than or equal to 0.5 mm. [10]

OR

14. Why the vibration analysis for a vehicle free vibration due to engine balance for the single degree of freedom is required? Explain with an example. [10]

15 a) A uniform rod hangs freely from a hinge at the top. Using the three modes $\Phi 1 = x/l$, $\Phi 2 = \sin(x/l)$, and $\Phi 3 = \sin(2x/l)$, determine the characteristic equation by using the Rayleigh-Ritz method?

b). Determine the flexibility matrix for the spring-mass system shown in Fig.15.1 [5+5]

OR

16. Using Holzer's method, determine the natural frequencies and mode shapes of the torsional system of Fig. 16.1 when $J = 1.0$ kg-m^2 and $K = 0.20 \times 10^6$ Nm/rad. [10]

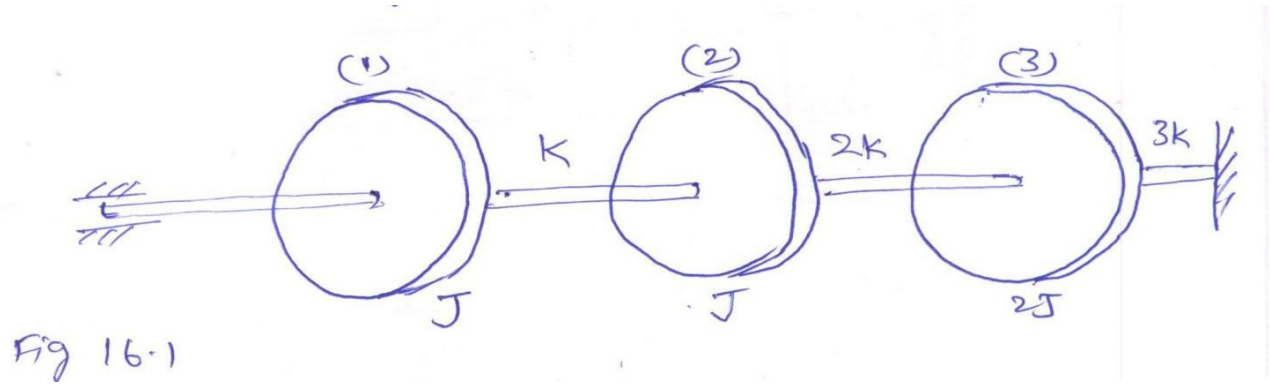

Fig 16.1

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17. Using the Rayleigh-Ritz method, determine the first two natural frequencies and mode shapes for the longitudinal vibration of a uniform rod with a spring of stiffness k0 attached to the free end, as shown in Fig17.1. Use the first two normal modes of the fixed-free rod in longitudinal motion. [10]

OR

18. A machine of 20 kg mass is to be mounted on a vibrating base. The base vibration rages from 60 Hz to 75 Hz. And the amplitude varies from 2 mm to 3 mm. If the machine is to be isolated such that the amplitude is less than or equal to 0.5 mm determine the equivalent stiffness of the isolator to be used? [10]

19. Why the vibration analysis for a vehicle free vibration due to engine balance for the single degree of freedom is required? Explain with an example. [10]

OR

20. What is the need for vibration analysis for a vehicle free vibration due to road roughness for the single degree of freedom? Explain with an example. [10]

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AERONAUTICAL ENGINEERING

MECHANICAL VIBRATION AND STRUCTURAL DYNAMICS

MODEL PAPER-II(R15)

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

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

1. Derive the expression for natural frequency of undamped free vibration system (3M)
2. Derive the equation of machine of undamped forced vibratory system (3M)
3. Explain briefly about hysteresis dumpily and coulomb dumpily. (2M)
4. Find the natural frequency of the system shown in fig-1. Take K_1 **=** K_2 **=1500 N/m,** K_3 **=2000 N/m and m= 5kg** (3M)

5. Derive the expression for natural frequency of undamped 2 DOF spring –mass system. (3M)
6. Write short notes on inference coefficients (2M)
7. Write the procedure to derive equation of motion using Lagrange's equation (2M)

8. Define the term vibration and write different types of vibrations (2M)
9. Define (1) Logarithmic decrement
   (2) Periodic and a periodic motion
   (3) Potential energy
   (3M)

10. Write short notes an
    (1) Principal coordinates
    (2) Semi-definite system
    (2M)

PART B **Max Marks: 50**

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

11. What effect does a decrease in mass have on the frequency of a systems (10M)

(OR)

12. A cylinder of mass M radius' **r** 'rolls without slipping on a cylindrical surface of radius '**R'**. Find the natural frequency for small oscillation about the lowest point. (10M)
13. Find the steady state response of undamped single DOR systems subjected to the force
    F(t)= $F_0 e^{iwt}$ by using the method of Laplace transformation (10M)

(OR)

14. Two rotors A & B are attached to the ends of a shaft 800mm long. The mass of the rotor '**A**' is 600 kg and is radius of gyration is 500mm. The corresponding values of rotor **B** 700kg and 600mm respectively. The shaft is 90mm diameter for the first 300mm, 150mm for next 180mm length and 120mm for the remaining length. Modulus of rigidity of the shaft material is $0.8x10^5 MN/n^2$. Find
    1) The position of the node.
    2) The frequency of torsional vibration (10M)

15. A uniform bar of length **l** is fixed at one end and the free end is stretched uniformly l_0 and released at t=o. find the resulting longitudinal vibration.
(10M)

(OR)

16. A uniform circled shaft of length l is fixed at the two ends. at its middle point a torque **To** is applied which twists it by 8_0 radians at the middle point. If the torque is released suddenly. Find the subsequent motion.
(10M)

17. Compare the mode shape of a rotating shaft with a stationary shaft assuming that the shaft is rotating on a soft bearing
(10M)

(OR)

18. (a) what is a principal coordinate
(b) the equation of motion of a two degrees of freedom system is given by

$$\begin{bmatrix} n & 0 \\ 0 & \frac{nL^2}{12} \end{bmatrix} + \begin{bmatrix} 2K & -\frac{KL}{4} \\ -\frac{KL}{4} & \frac{5KL^2}{16} \end{bmatrix} \begin{bmatrix} x \\ 8 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

The eigenvectors for the above system given by $X_1 = \begin{bmatrix} 1 \\ 1.43 \\ L \end{bmatrix}$, $X_2 = \begin{bmatrix} 1 \\ -8.42 \\ L \end{bmatrix}$

Calculate the principal coordinates of the system.
(10M)

19. a) What are static and dynamic couplings?
b) Derive the differential equations governing free vibration of the system shown in figure 19.1, comprising a straight slender balance Supported by two springs and discuss the coupling using **x and θ** as generalized coordinates
(4+6M)

OR

20. What is the need for vibration analysis for a vehicle free vibration due to road roughness for the single degree of freedom? Explain with an example. (10M)

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MECHANICAL VIBRATION AND STRUCTURAL DYNAMICS

MODEL PAPER-III(R15)

MAXIMUM MARKS: 75

PART A **Max Marks: 25**

iAll questions in this section are compulsory

iiAnswer in TWO to FOUR sentences.

1. Derive the expression for natural frequency of undamped free vibration system (3M)
2. Derive the equation of machine of undamped forced vibratory system.(3M)
3. Explain briefly about hysteresis dumpily and coulomb dumpily.(2M)
4. Find the natural frequency of the system shown in fig-1. Take K_1**=**K_2**=1500 N/m,**K_3**=2000 N/m and m= 5kg (3M)**

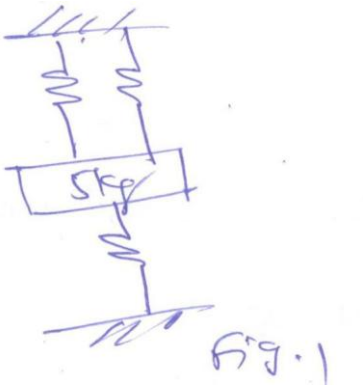

Fig.1

5. Derive the expression for natural frequency of undamped 2 DOF spring –mass system.(3M)
6. Write short notes on inference coefficients (2M)
7. Write the procedure to derive equation of motion using Lagrange's equation(2M)
8. Define the term vibration and write different types of vibrations(2M)
9. Define (1) Logarithmic decrement
   (2) Periodic and a periodic motion
   (3) Potential energy (3M)

10. Write short notes an
    (1) Principal coordinates

(2) Semi-definite system (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. What effect does a decrease in mass have on the frequency of a systems

(OR)

12. A cylinder of mass M radius' **r** 'rolls without slipping on a alindrical surface of radius '**R'**. Find the natural frequency for small oscillation about the lowest point.
13. Find the steady state response of undamped single DOR systems subjected to the force
F(t)= $F_0 e^{iwt}$ by using the method of laplace transformation

(OR)

14. Two rotors A & B are attached to the ends of a shaft 800mm long. The mass of the rotor '**A**' is 600 kg and is radius of gyration is 500mm. The corresponding values of rotor **B** 700kg and 600mm respectively. The shaft is 90mm diameter for the first 300mm, 150mm for next 180mm length and 120mm for the remaining length. Modulus of rigidity of the shaft material is $0.8x10^5 MN/n^2$. Find

3) The position of the node.
4) The frequency of torsional vibration

15. A uniform bar of length **l** is fixed at one end and the free end is stretched uniformly l_0 and released at t=o. find the resulting longitudinal vibration.

(OR)

16. A uniform circled shaft of length l is fixed at the two ends at its middle point a torque **To** is applied which twists it by 8_0 radians at the middle point. If the torque is released suddenly. Find the subsequent motion.
17. Compare the mode shape of a rotating shaft with a stationary shaft assuming that the shaft is rotating on a soft bearing.

(OR)

18.(a) what is a principal coordinate
(b) the equation of motion of a two degrees of freedom system is given by

$$\begin{bmatrix} n & 0 \\ 0 & \frac{nL^2}{12} \end{bmatrix} + \begin{bmatrix} 2K & -\frac{KL}{4} \\ -\frac{KL}{4} & \frac{5KL^2}{16} \end{bmatrix} \begin{bmatrix} x \\ 8 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

The eigen vectors for the above system or given by $X1 = \begin{bmatrix} 1 \\ 1.43 \\ L \end{bmatrix}$, $X2 = \begin{bmatrix} 1 \\ -8.42 \\ L \end{bmatrix}$

Calculate the principal coordinates of the system.

19. a) what are static and dynamic couplings?

    b) derive the differential equations governing free vibration of the system shown in figure 19.1,comprising a straight slender balance Supported by two springs and discuss the coupling using **x and θ** as generalized coordinates

(OR)

20. The rigid beam shown in figure in its position of static equilibrium in the figure has a mass m and a mass moment of inertia $2ma^2$ about an axis perpendicular to the plane of the diagram and through its centre of gravity G. assuming no horizontal motion of G, derive the equation of motion considering the vertical displacement of CG and the rotation about the CG as the coordinates. Find the frequencies of small oscillations and the corresponding position of nodes. Identify the natural coordinates for decoupling the equations of motion.

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MECHANICAL VIBRATION AND STRUCTURAL DYNAMICS

MODEL PAPER-IV(R15)

MAXIMUM 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 stiffness influence coefficients[2]
2. Derive the equation of motion of a simple spring mass system using energy method[3]
3. Define the terms SHM, resonance and time period[3]
4. Explain briefly about and coulomb dumping[3]
5. Write short notes on vibration isolation [2]
6. What is meant by static coupling in vibration system [3]
7. Write short notes on modeshapes with examples[2]
8. Write the procedure to find eigenvalue for the 3 DOF system[3]
9. Write short notes on transfer function in vibrations[2]
10. List out some vibration applications in airborne system[2]

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.

11. Define force transmissibility and obtain expression for
    i. Force transmissibility
    ii. Phase leg of transmitted force with impressed force.

(OR)

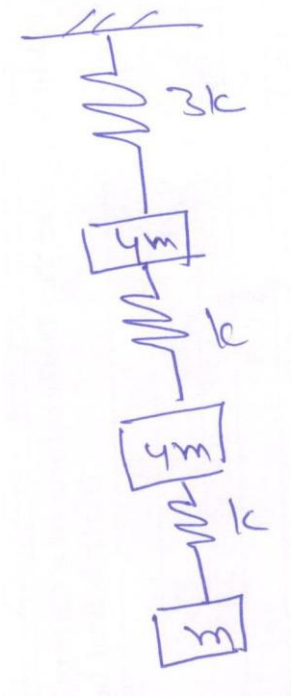
A machine of mass 100kg cylinder at 600 rpm has a rotating **unbalance** of 100kg .mm. The machine is mounted on springs having stiffness 85 KN/m and negligible damping. The system is contained to more axially.

a. Determine the steady state amplitude.
b. If the damping is introduced to reduce the amplitude. By 50%, what should be the damping coefficient also find damping factor.

13. Find the fundamental natural frequency of Transverse vibration for the student shown in fig.1 by **dunkerles** method.

(OR)

14. Find the fundament material frequency for the system shown in fig.2 by the method of matrix iteration



15. a) State the types of damping and explain in brief viscous damping.
    b) A spring mass- dashpot system has mass 10kg and stiffness 40N/m. if the amplitude of free vibration decreases to 25% of original value after 5 c**ycles.** Determine the damping coefficient.

(OR)

16. Define logarithmic decrement show that logarithmic decrement can be expressed as $\mathbf{S=\frac{l}{n}\log e^{\frac{x_o}{x_n}}}$ (derive the expression), where x_o is amplitude at particular maximum and x_n is amplitude after on cycles.
17. A mass of 100 kg is suspended on a spring having a stiffness of 19600 N/m and is acted up on by a harmonic force of 39.2 N at the undamped natural frequency. The damping coefficient is 98 N-S/m, determine**.**
    a) Undamped natural frequency
    b) Amplitude of vibration of mass.
    c) Phase difference between force and displacement.

(OR)

18. A spring is tightly stretched between two supports as shown in fig.3. The tension T θ In the spring may be assumed to be constant for small displacement. Obtain the two natural frequencies for the system.

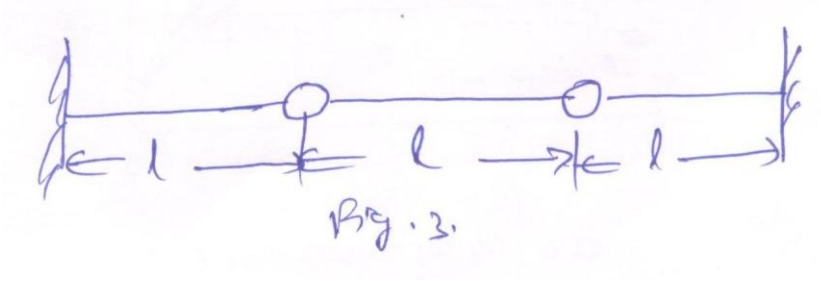


Fig. 3.

19. Derive the expression for longitudinal vibration of a bar.

(OR)

20. Derive the expression for vibration of string under tension.

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MECHANICAL VIBRATION AND STRUCTURAL DYNAMICS

MODEL PAPER-V(R15)

MAXIMUM 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 influence coefficients[2]
2. Define the terms damping factor and logarithmic decrement[3]
3. What are continuous systems? explain[2]
4. Derive the equation of motion of a simple spring mass system using Newton's laws of motion[3]
5. Define the terms periodic motion, phase difference and DOF[2]
6. Explain briefly about modal analysis [3]
7. Differentiate discrete systems and distributed systems in vibrations[2]
8. Derive the equation of machine of undamped forced vibratory system[3]
9. Explain briefly about hysteresis dumping[2]
10. Explain briefly about dynamic coupling in vibration system[3]

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. Using **stodola** method find the fundamental natural frequency and mode shape of the system shown in fig .1

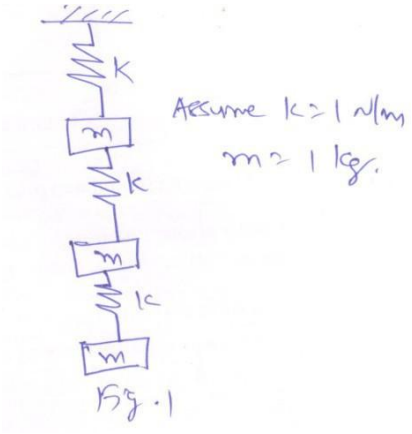


Fig.1

(OR)

12. a). Derive the following terms
    i. Resonance
    ii. Simple harmonic motion
    iii. Time period

    b) Analyse the following motion

    X_1 =2 Cos (wf + 0.5)

    X_2 = 5 sin (wf +1.0)

13. A spring of an auto mobile frailer are compressed 0.1 under its own weight. Find the critical speed when the auto mobile is traveling over a road with a profile approximated by a sine wave of amplitude 0.08m and a wavelength of 14m. What will be the amplitude of..... At 60 Km/hr.

(OR)

14. Determine the natural frequencies and mode shapes for a system shown in fig.2. J_1 and J_2 are mass moment inertias of the discs K_t isfor final stiffness of shaft.

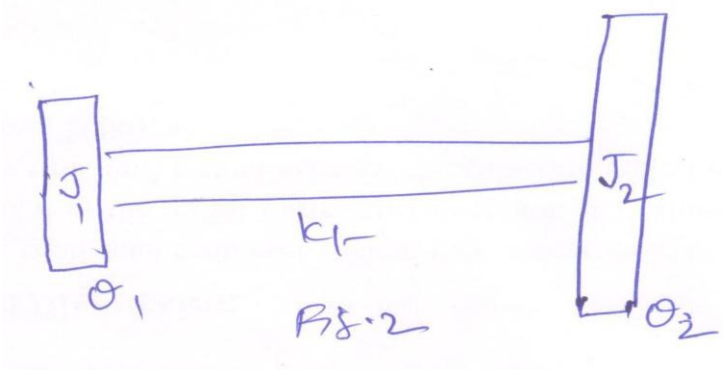
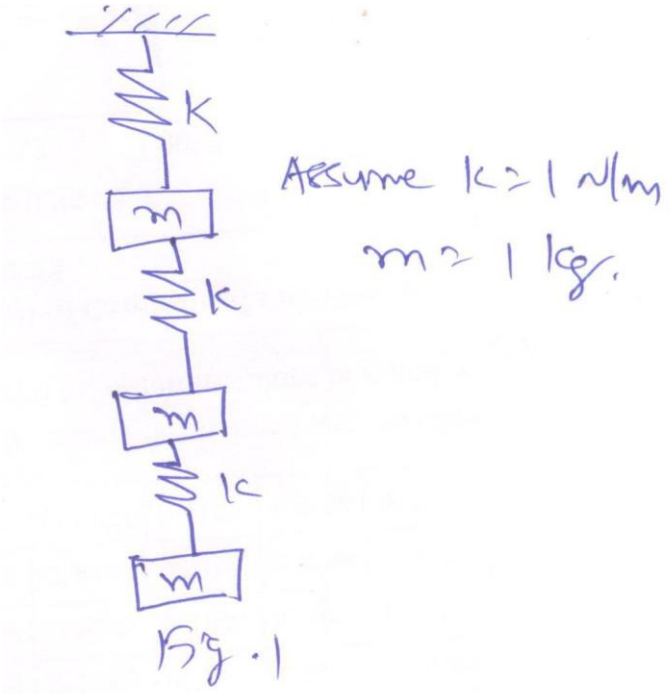


Fig.2

15. A steel cantilever become carrying a weight of 100gms at the free end is used as frequency meter. The beam has a length of 10cm, weight of 0.5gm and thickness of 2mm. The internal friction is equivalent to a damping ratio of 0.05. When the fixed end of the beam is subjected to a harmonic displacement y(t)= 0.5 Cos wt cm, the maximum tip displacement is observed to be 2.5cm, find the forcing frequency w.

(OR)

16. Using **stodola** method find the fundamental natural frequency and mode shape of the system shown in fig .1



17. a). Derive the following terms
    - iv. Resonance
    - v. Simple harmonic motion
    - vi. Time period

    b) Analyse the following motion

    X_1 =2 Cos (wf + 0.5)

    X_2 = 5 sin (wf +1.0)

(OR)

18. A spring of an auto mobile trailer are compressed 0.1 under its own weight. Find the critical speed when the auto mobile is traveling over a road with a profile

approximated by a sine wave of amplitude 0.08m and a wavelength of 14m. What will be the amplitude of 5cm at 60 Km/hr.

19. Derive the expression for torsional vibration of a shaft.

(OR)

20. Derive the expression for transverse vibration of a beam.