INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Code No: **BCC213**

MODEL QUESTION PAPER - II

M.Tech II Semester Regular Examinations, August 2017

STRESS ANALYSIS AND VIBRATION

(CAD/CAM)

Time: 3 hours Max. Marks: 70

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT-I

1. (a) What are conjugate harmonic functions and analytic functions? Give the property of the analytic functions. [7M]

   (b) Determine the stress and displacement fields in an infinite medium due to equal and opposite point forces acting at different points along their common line of action. [7M]

2. (a) Derive Airy's stress function of a two dimensional state of stress in polar coordinate system. [7M]

   (b) A cantilever beam of rectangular cross-section 30 mm wide and 50 mm thick is 700 mm in length. It carries a load of 600 N at the free end. Determine the stresses in the cantilever at mid-length. [7M]

UNIT-II

2. (a) Derive the governing equation of bending of a cantilever, with a non-uniform cross-section, subjected to load P at its free end. [7M]

   (b) A hollow aluminium section of external dimensions 100 mm x 50 mm and thickness 5 mm is designed for a maximum shear stress of 35 Mpa. Find the maximum permissible twisting moment for this section and the angle of twist under this moment per metre length. G = 28 GPa. [7M]

3. (a) Derive the governing differential equation of bending of a bar of a rectangular cross-section in terms of stress functions [7M]

   (b) A prismatic bar of length 5m and a rectangular cross-section of 80mm x100mm is fixed at one end as a cantilever. At the free end, 1 kN load acting in the plane of the cross-section but inclined at 30o to the vertical is applied. Determine the maximum stress in the cantilever beam. [7M]

UNIT-III

4. (a) Derive an expression for the transmissibility and transmitted force for a spring - mass-damper system subjected to external excitation. Draw the vector diagram for the forces [7M]

   (b) In a particular case of a large canon, the gun barrel and recoil mechanism have a mass of 500kg with recoil spring stiffness 10,000N/m. The gun recoils 0.4m upon firing. Find i) Critical damping co efficient of the damper. (ii) Initial recoil velocity of the gun. [7M]

5. (a) What is meant by static and dynamic coupling? How can coupling of the equations of motion be eliminated? Derive the governing equations through Lagrange energy approach. [7M]

(b). In the vibration testing of a structure, an impact hammer with a load cell to measure the impact force

is used to cause excitation. Assuming m=15kg, k=3000n/m, c=20Ns/m and F=30 N. Find the response of the system. [7M]

UNIT-IV

6. (a) What mathematical concepts to be used in writing the characteristic equations of single degree of freedom systems which undergo transient vibrations? [7M]

   (b) Calculate the equation of motion of undamped free vibration of single degree of freedom systems using Duhamel's integral method. [7M]

7. (a) Explain briefly unit step function, rectangular pulse and unit impulse functions. [7M]

   (b) A force F(t) is unit step function applied to a mass m which is supported by a spring with a constant stiffness 'k'. After a short period of time T, the force is suddenly removed. During the time the force is active, it is a constant, F. Determine the response of the system if t> T. The spring and mass are initially at rest before the force F (t) is applied. [7M]

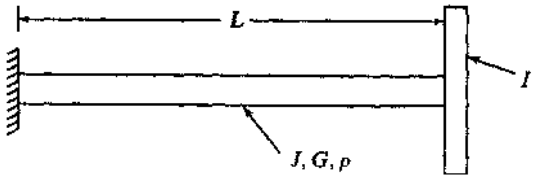
UNIT-V

8. (a) Derive the general solution of transverse vibration of beams. [7M]

   (b) Derive suitable expression for longitudinal vibrations for a rectangular uniform cross section bar of length l fixed at one end and free at the other end. [7M]

10. (a) Derive the general solution of the lateral vibrations of a string. [7M]

(b) The circular shaft of Figure below, is fixed at x = 0 and has a thin disk of mass moment of inertia / attached at x = 1. Determine the natural frequencies for this system, identify the orthogonality condition satisfied by the mode shapes, and determine the normalized mode shapes. Shaft has disk of moment of inertia I attached at its free end. [7M]



INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Code No: **BCC004**

MODEL QUESTION PAPER - II

M.Tech II Semester Regular Examinations, August 2017

DESIGN OF HYDRAULICS AND PNEUMATIC SYSTEMS

(CAD/CAM)

Time: 3 hours Max. Marks: 70

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT-I

1.	(a)	Describe the environmental issues dealing with developing biodegradable fluids, reduce oil leakage and reducing noise levels.	[7M]
	(b)	Discuss the general criteria to be considered for selection of hydraulic fluid.	[7M]
2.	(a)	Compare the use fluid power to a mechanical system by listing the advantages and disadvantages of each.	[7M]
	(b)	Differentiate between hydraulics and pneumatics.	[7M]

UNIT-II

3.	(a)	Why cushioning needed in a hydraulic cylinder. Explain with a neat sketch, the principle of operation of a fixed cushioned cylinder.	[7M]
	(b)	Classify the hydraulic pumps. Describe the working of rotary pumps Piston pumps. What are merits of it.	[7M]
4.	(a)	Explain detail about selection, specifications and characteristics of linear rotary actuator.	[7M]
	(b)	A cylinder has a bore of 125mm diameter and a rod of 70mm diameter. It drives a load of 2000kg vertically up and down at a maximum velocity of 3m/s. The load is slowed down to rest in the cushioning length of 50mm. If the relief valve is set at 140 bar, determine the average pressure in the cushions while extending and retracting.	[7M]

UNIT-III

5.	(a)	Design and sketch pressure relief valve for 10 to 20 bar pressure valve.	[7M]
	(b)	Discuss the details of the following factors in selection of hydraulic pump.	[7M]
6.	(a)	Design and sketch the hydraulic power pack of 20 liter capacity with a gear pump and induction motor and other required elements.	[7M]
	(b)	How the hydraulic motors are rated and derive on equation for torque of the motor.	[7M]

UNIT-IV

7.	(a)	Design a bleed-off circuit in pneumatic systems, write down the applications of bleed-off circuit.	[7M]
	(b)	Design a hydraulic circuit with check valves. Explain the use of check valves. Merits, demerits and applications.	[7M]
8.	(a)	Design a hydraulic circuit with check valves. Explain the use of check valves. Merits, demerits and applications.	[7M]
	(b)	What is an accumulator. State the application of accumulator. Enumerate the different configurations of linear actuators.	[7M]

UNIT-V

9.	(a)	Explain PLC and logical gates in PLC with examples.	[7M]

	(b)	Differentiate between LCA and microcontroller.	[7M]
10.	(a)	Explain functioning of relay circuit. How it is used in automation.	[7M]
	(b)	Explain use of microcontroller for sequencing, Explain how microcontroller is used in automation, with a neat sketch, applications	[7M]