Code No.: **40324**

MR14

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD)

Gundlapochampally (H), Maisammaguda (V), Medchal (M), Medchal-Malkajgiri (Dist), Hyderabad

III B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS, DECEMBER-2019

Subject: **FINITE ELEMENT METHODS**

Branch: **ME**

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

PART – A

I. Answer ALL questions of the following **5x1Mark=5 Marks**

1. What is meant by finite element method?
2. State principle of minimum potential energy
3. Define beam.
4. Sketch 2-D 4-noded isoparametric element.
5. What are the types of Eigen value problems?

II. Answer ALL questions of the following **10x2Marks=20 Marks**

1. Give the equation of load vector for 1D- bar element.
2. What is the general description and use of FEM?
3. Show the shape function diagrams for1D- 3-noded problems.
4. Explain penalty approach.
5. Construct the hermit shape functions of the beam?
6. Write short notes on different types of loading on beams.
7. Formula for strain displacement matrix of the CST element?
8. What is meant by iso-parametric element? Write down the shape functions for 4 noded rectangular element using natural co-ordinate system?
9. What are the modes of heat transfer? Write down the finite element equation for one dimensional heat conduction problem?
10. Specify the applications of heat transfer problems.

PART-B

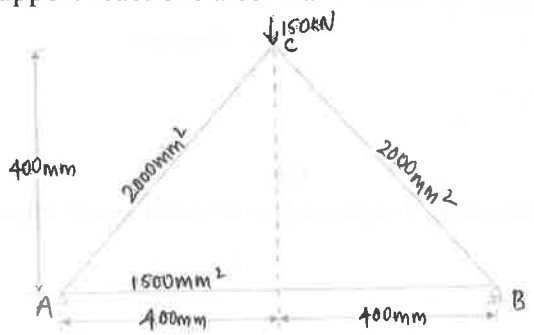
Answer ALL questions of the following **5x10 Marks= 50Marks**

1. a) Write the differences between continuum method and FEM.
   b) Write any six applications of FEM.

OR

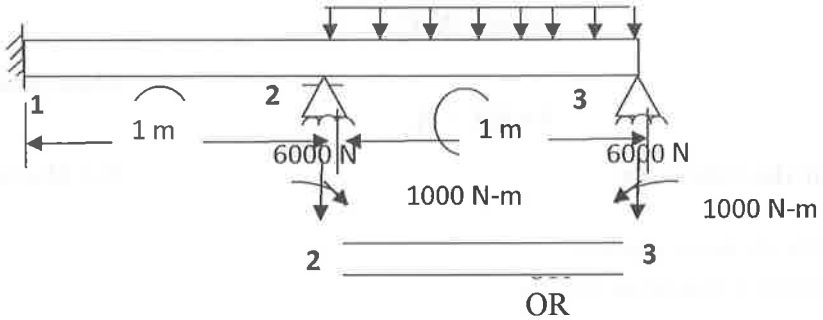
2. Derive the strain displacement equations and equations of equilibrium.

3. For the three – bar truss shown in Figure, determine the modal displacements and the stress in each member. Find the support reactions also. Take modulus of elasticity as 200 GPa.



OR

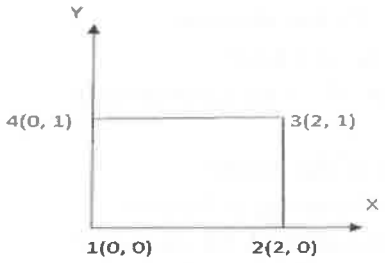
4. Briefly discuss elimination approach to handle boundary conditions for solution of system of equations?
5. The beam and loading shown in Figure. Determine a) the slopes at 2 and 3 and b) the vertical deflection at the mid point of the distributed load. E = 200 GPa I = $4x10^6$ mm^4



OR

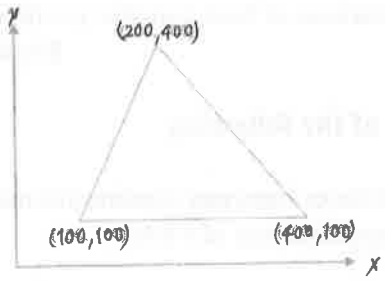
6. Derive the stiffness matrix for beam element.

7. A four noded rectangular element is shown in figure. Determine a) Jacobian Matrix b) Strain – Displacement Matrix c) Element Stresses Take E = 2 x 10^5 N/mm^2, v = 0.25, $\xi = \eta = 0$, U= [0, 0, 0.003, 0.004, 0.006, 0.004, 0, 0]^T. Assume Plane Stress conditions.

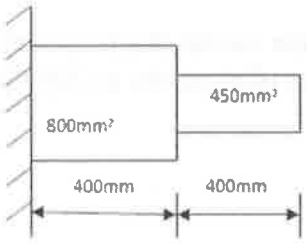


OR

8. For the CST element shown in figure, assemble strain-displacement matrix. Take, t=20mm, E = 2 x 10^5 N/mm^2.



9. Determine the natural frequencies and mode shapes using characteristic polynomial technique



E= 200 GPa

ρ = 7850 Kg/m³

OR

10. Derive the basic Governing Differential Equation for 1D-heat conduction with convection?

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III B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS, DECEMBER-2019

Subject: **REFRIGERATION & AIR CONDITIONING**

Branch: **ME**

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

PART – A

I. Answer ALL questions of the following **5x1Mark=5 Marks**

1. Define the term "Tonne of refrigeration".
2. What do you mean by VCRS?
3. What benefit absorption system offer compared to compression system?
4. What is relative humidity?
5. Name different types of Air filters.

II. Answer ALL questions of the following **10x2Marks=20 Marks**

1. What factors are considered for the selection of ideal refrigerants?
2. How to calculate the ton of refrigeration. Explain in detail.
3. Discuss about Hermetically sealed compressor.
4. Write about C.O.P of VCRS.
5. In an absorption refrigeration system, heating, cooling and refrigeration takes place at temperatures of 150°C, 30°C and -20°C. Find the theoretical COP.
6. Write about the functioning of rectifier in VARS.
7. Explain the concept of apparatus dew point temperature.
8. What is the need of ventilation in air conditioning systems?
9. List the important considerations in the design of air conditioning system.
10. What is the use of fans and blowers in air conditioning systems?

PART-B

Answer ALL questions of the following **5x10 Marks= 50Marks**

1. With a neat sketch explain the working principle of Bell Coleman refrigeration system.

OR

2. Discuss about Thermodynamic properties of refrigerants.

3. A F-12 vapor compressor refrigeration system has a condensing temperature of 50^0C and evaporating temperature of 0^0C. The refrigeration capacity is 7 tones. The liquid leaving the condenser is saturated liquid and compression is isentropic. Determine the refrigeration flow rate, the power required to run the compressor, the heat rejection in the plant and C.O.P. of system.

OR

4. With a neat p-h and T-S diagrams explain the effect of sub cooling and super heating in Vapor compression refrigeration system.

5. Explain, with the help of a neat sketch, the working of a steam jet refrigeration system.

OR

6. The following data refers to a 20 TR ice plant using ammonia as refrigerant:

The temperature of water entering and leaving the condenser are 20°C and 27°C and temperature of brine in the evaporator is -15°C. Before entering the expansion valve, ammonia is cooled to 20°C and the ammonia enters the compressor dry saturated.

Calculate for one tone of refrigeration the power expended, the amount of cooling water in the condenser and the coefficient of performance of the plant. Take specific heats for liquid and vapour ammonia as 4.606 and 2.805 kJ/kg K at 25°C.

7. The Sling-psychrometer reads 40°C DBT and 28°C WBT. Calculate: i) Specific humidity ii) Relative humidity iii) Vapour density in air iv) Dew point temperature v) Enthalpy of the mixture per kg of dry air.

OR

8. A conference hall of 60 seating capacity is to be air conditioned for comfort conditions of 22^0C DBT and 55% RH. The out door conditions are 32^0C DBT and 22^0C WBT. The quantity of air supplied is 0.5 m^3/min/person. The comfort conditions are achieved by chemical de humidification and by cooling coil. Determine DBT of air at exit of dehumidifier and capacity of dehumidifier.

9. Explain the main factors of "Effective Temperature" and its significance in the design of air conditioning system.

OR

10. Explain in detail how the human body reacts to changes in temperature of environment. Also explain the effect of activities on the heat load calculation for comfort application.

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III B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS, DECEMBER-2019

Subject: **HEAT TRANSFER**

Branch: **ME**

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

PART – A

I. Answer ALL questions of the following **5x1Mark=5 Marks**

1. Name some good conductors of heat; some poor conductors.
2. What does Extended surface mean?
3. How does Rayleigh number differ from Grashof number?
4. What is Condensation process?
5. What is a heat exchanger?

II. Answer ALL questions of the following **10x2Marks=20 Marks**

1. What is the difference between thermodynamics and heat transfer?
2. What is meant by the term "one-dimensional" when applied to conduction heat transfer?
3. Define transient heat conduction. Give one example
4. Give the expression that will be used for unsteady heat transfer condition with $B_i<0.1$
5. What is the physical significance of the Nusselt number?
6. In forced convection, distinguish between upstream velocity and free stream velocity. For which type of flow are the two same?
7. Differentiate between pool boiling and forced convection boiling.
8. Explain briefly the condensation mechanism.
9. What is thermal radiation? How does it differ from other forms of electromagnetic radiation?
10. When is a heat exchanger classified as compact?

PART-B

Answer ALL questions of the following **5x10 Marks= 50Marks**

1. a) What are the composite walls ? How can equivalent thermal resistances be calculated for walls in parallel and series arrangement?
   b) Define critical radius of insulation? Derive critical radius for sphere.

OR

2. a) A brick wall of thermal conductivity (k=70 W/mK) is 30 cm thick. If the temperature of the inner and outer surfaces are maintained at 50^0C and 30^0C respectively. Calculate the heat loss through one square meter area. Find also the temperature at an interior point of the wall 24 cm distant from the outer wall?
   b) Define critical radius of insulation? Derive critical radius for cylinder.

3. a) $\theta = C_1 e^{mx} + C_2 e^{-mx}$

Where each term has its usual meaning, now from this general solution, derive temperature distribution for short fin with insulated TIP using appropriate boundary conditions.

b) A stainless steel rod of outer diameter 1 cm originally at a temperature of 320°C is suddenly immersed in a liquid at 120°C for which the connective heat transfer coefficient is 100 W/m^{2}K. Determine the time required for the rod to reach a temperature of 200°C.

OR

4. a) Explain the method of error measurement of temperature. **[4M]**

b) A long steel cylinder12cm in diameter and initially at 20^0 C is placed into a furnace at 820^0 C with the heat transfer coefficient =140 W/m^{2}K .Calculate the time required for the axis temperature to reach 800^0 C. Also calculate the corresponding temperature at a radius of 5.4cm at that time. The properties of steel are $\alpha = 6.11 \times 10^{-6}$m^2 /s, K=21 W/mk. **[6M]**

5. a) Explain for fluid flow along a flat plate the velocity distribution in hydrodynamic boundary layer. **[4m]**

b) What are repeating variables and how are they selected for dimensional analysis **[6m]**

OR

6. Air flow through a long rectangular (30 cm height x 60 cm width) air conditioning duct maintains the outer duct surface temperature at 15° C.If the duct is uninsulated and exposed to air at 25° C, calculate the heat gained by the duct per metre length, assuming it to be horizontal.

7. A square plate, 40 cm x 40 cm, is at 120^{0}C and is exposed to air at 20^{0}C. Find the heat loss from the plate if a) The plate is kept vertical b) The plate is placed horizontally. Find the percentage change in heat flow due to the change in position.

OR

8. a) S.T by dimensional analysis that data for free convection may be correlated by an equation of the form Nu = f(Gr Pr).

b) Calculate the convective heat loss from radiator 0.5m wide and 1m high maintained at a temperature of 84°C, in a room at 20°C. Treat radiator has a vertical plate.

9. a) Hot oil with a capacity rate of 2500 W/K flows through a double pipe heat exchanger. It enters at 360^0 C and leaves at 300^0 C .Cold fluid enters at 30^0 C and leaves at 200^0 C. If the overall heat transfer coefficient is 800 W/ m^2 K, determine the heat exchanger area required for (i) parallel flow (ii) counter flow. **[6m]**

b) Give comparison of parallel flow and counter flow heat exchangers. **[4m]**

OR

10. a) Explain in detail the classification of heat exchangers with neat sketches.

b) Water is heated from 20^{0}C to 50^{0}C by steam condensing at 120^{0}C. If the water flow rate remains constant but its temperature drops to 15^{0}C, what will its new outlet temperature be?