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RM-7171

B. E. III (Sem. VI) (Mech.) Examination

May / June – 2010

Computer Aided Engg. Analysis

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 3 (Sem. 6) (Mech.)**

Name of the Subject :

☛ **Computer Aided Engg. Analysis**

☛Subject Code No. : **7 1 7 1** ☛Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Attempt **all** questions.
(3) Figures to the **right** indicate full marks.
(4) Use of pocket calculator is allowed.
(5) Assume suitable data if **necessary**.
(6) Answer to the two sections must be written in two separate answer book

1 (a) Answer the following : **2**

(i) $A = \begin{bmatrix} 1 & -4 & 5 \\ 3 & 7 & -1 \\ 1 & 15 & -11 \end{bmatrix}$

find the rank of matrix A

(ii) Define Computer Aided Engg. Analysis. **2**

(iii) Differentiate between numerical method and Analytical Method. **2**

(iv) List four types of problems encountered in Mech. Engg. in which Computer Aided Engg. Analysis can be useful. **2**

(v) Define **2**
- Absolute error in Numerical computation.
- Skew-Symmetric matrix.

(b) Solve the following equations by LU decomposition method. **8**

$2x + 3y + z = 9$
$x + 2y + 3z = 6$
$3x + y + 2z = 8$

OR

(b) Solve the following system of equation accurate to four significant digits (6 iterations required) 8

$10\ x_1 + x_2 + 2x_3 = 44$

$2x_1 + 10x_2 + x_3 = 51$

$x_1 + 2x_2 + 10x_3 = 61$

Use Gauss-Seidel method.

2 Attempt any **two** : **14**

(i) If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form P = mW + C connecting P and W, using the following data.

P	12	15	21	25
W	50	70	100	120

Where P and W are taken in kg-wt. Compute P when W = 150 kg.wt.

(ii) The following table gives the value of x and y.

x :	1.2	2.1	2.8	4.1	4.9	6.2
y :	4.2	6.8	9.8	13.4	15.5	19.6

Find the value of x corresponding to y = 12 using Lagrange's interpolating formula.

(iii) From the following table, estimate the number of students who obtained marks between 40 and 45.

Marks :	30-40	40-50	50-60	60-70	70-80
No. of students :	31	42	51	35	31

3 Attempt the following : **18**

(i) Find the root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to three decimal places. **6**

OR

(i) Using Newton-Raphson method find the root of the equation. **6**

$x + \log_{10} x = 3.375$ correct to four significant figures.

(ii) function f(x) is given as follows : **6**

x :	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
y :	1.001	1.008	1.027	1.064	1.125	1.216	1.343	1.512	1.729	2.0

Compute the integral of f(x) between x=0.1 and x = 1.0 Use Simpson's (3/8)th rule.

OR

(ii) The velocity V (km/min) of a moped which starts from rest is given at a fixed interval of time t (min) as follows : **6**

t :	2	4	6	8	10	12	14	16	18	20
u :	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes.

(iii) The distance (s) covered as a function of time (t) by an athlete during his/her run for the 50 meter race given in the followin table.

Time (secs.):	0	1	2	3	4	5	6
Distance (mts.) :	0	2.5	8.5	15.5	24.5	36.5	50

Find the speed of athlete at t = 4.5 seconds.

OR

(iii) Given that **6**

x :	1.0	1.1	1.2	1.3	1.4	1.5	1.5
y :	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1

4 (a) Answer the following questions : **10**

(i) Write the general second order partial differential equation and classify it. **4**

(ii) Differentiate between local numbering and global numbering used in FEM. **3**

(iii) Define predicter-corrector method. **2**

(iv) 3rd order R.K. method agrees with Taylor's series method upto _____ term. **1**

(b) Solve the equation $\frac{\partial y}{\partial t} = \frac{\partial^2 y}{\partial x^2}$ subject to **10**

conditions $u(x, 0) = \sin \pi x,\ 0 \le x \le 1,\ u(o, t) = u(1, t) = 0$ using implicit method. Carryout the calculation for two levels taking. $h = \frac{1}{3}, k = \frac{1}{36}$

5 (a) The angular displacement θ of a simple pendulum **15**

is given by equation $\frac{d^2\theta}{dt^2} + \frac{g}{l} \sin \theta = 0$

Where l = 98 cm, g = 980 cm/sec^2 if θ = 0 and $\frac{d\theta}{dt}$ = 4.472 at t = 0. Use 4th order R.K. method to find θ and $\frac{d\theta}{dt}$ when t = 0.2 sec. Take θ in radian.

OR

5 (a) The deflection of a beam is governed by equation.

$\frac{d^4y}{dx^4} + 81\, y = \phi(x)$.

Where $\phi(x)$ is given by the table.

x	1/3	2/3	1
ϕ(x)	81	162	243

and boundary condition

$y(0) = y'(0) = y''(1) = y'''(1) = 0.$

Evaluate the deflection of beam at the pivotal points of beam using three sub-intervals.

6 Attempt any **one** : **15**

(a) Consider the thin (steel) plate. The plate has a uniform thickness t = 1 cm, E = 30 x $10^6 \frac{N}{cm^2}$, $\rho = 0.2836 \frac{kg}{cm^3}$ in addition to its self weight, the plate is subjected to point load P = 100 N at mid point.

(i) model the plate with 2 elements

(ii) Write equation for element stiffness matrics and element body force vector.

(iii) Assemble the structural stiffness matrix and global load vector.

(iv) Using elimination approach solve global displacement vector.

(v) Evaluate stress in each element.

(vi) Determine reaction force at support.

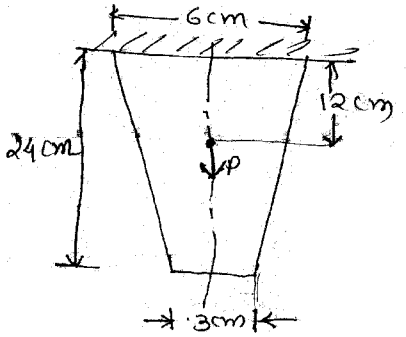

Fig. 1

(b) A composite wall consists of 3-materials the inside wall temperature is 200°C and outside air temperature is 50°C with convection co-efficient is 10 W/m^{2}K. Determine the interface temperature of composite wall.

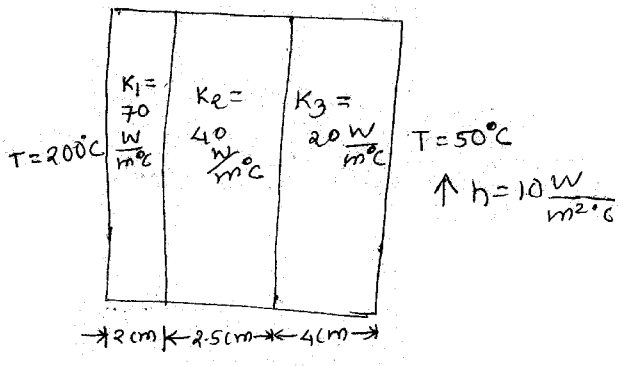

Fig. 2