

**SUBJECT CODE NO: E-8005**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Structural Engg.) Examination Nov/Dec 2017**  
**Advanced Structural Mechanics -II**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

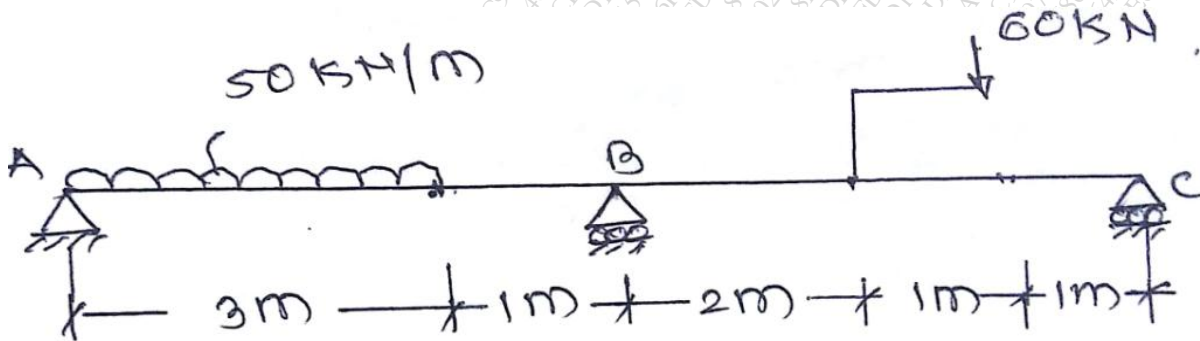
N.B

Please check whether you have got the right question paper.

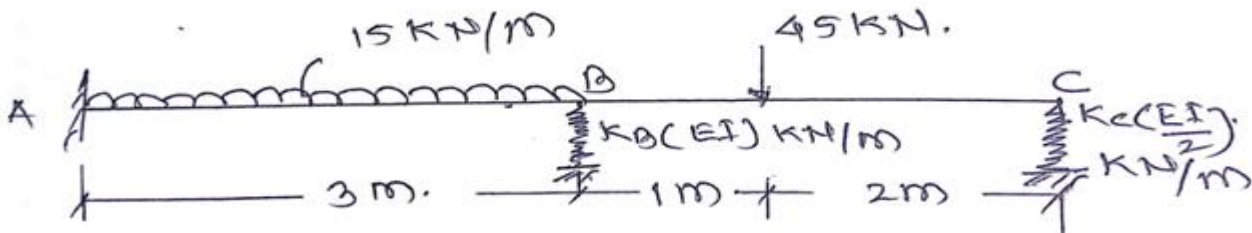
- 1) Solve any two questions from each section.
- 2) Assume suitable data, if required.

**Section A**

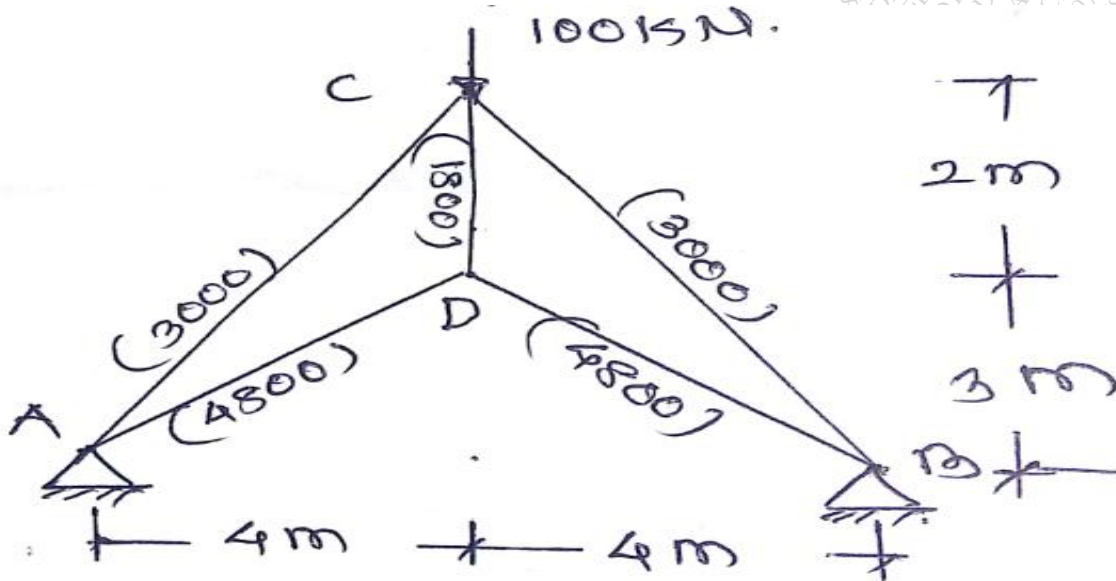
- Q.1 a) State the various methods to finding slope and deflection. 05
- b) Analyse the continuous beam by using flexibility method. 15



- Q.2 a) Differentiate between statically determinate & indeterminate structures. 05
- b) Analyse the beam as shown in fig. by flexibility method. Take EI is constant. The stiffness coefficients of spring at B & C are as shown in fig. 15



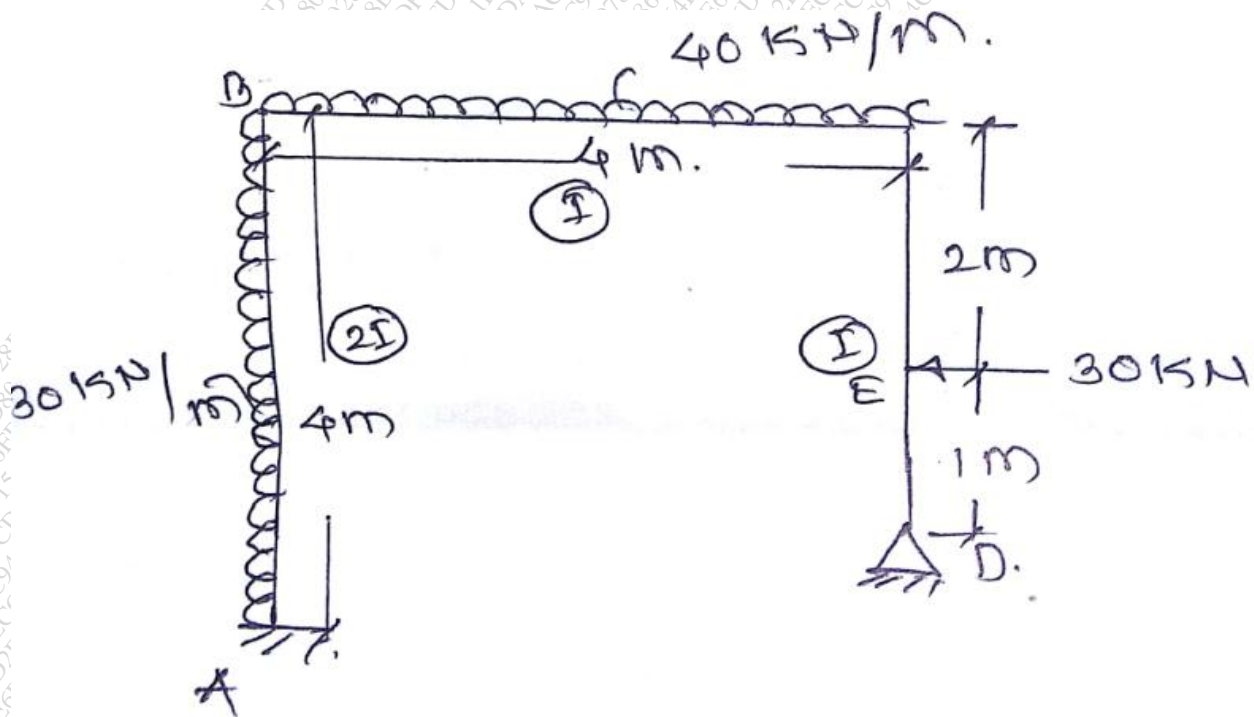
Q.3 Analyse the pin-jointed frame by the flexibility matrix method. Also calculate the force in member CD. In 20 the figure, the numbers in parentheses are the C/S area of the members in  $\text{mm}^2$ .



### Section B

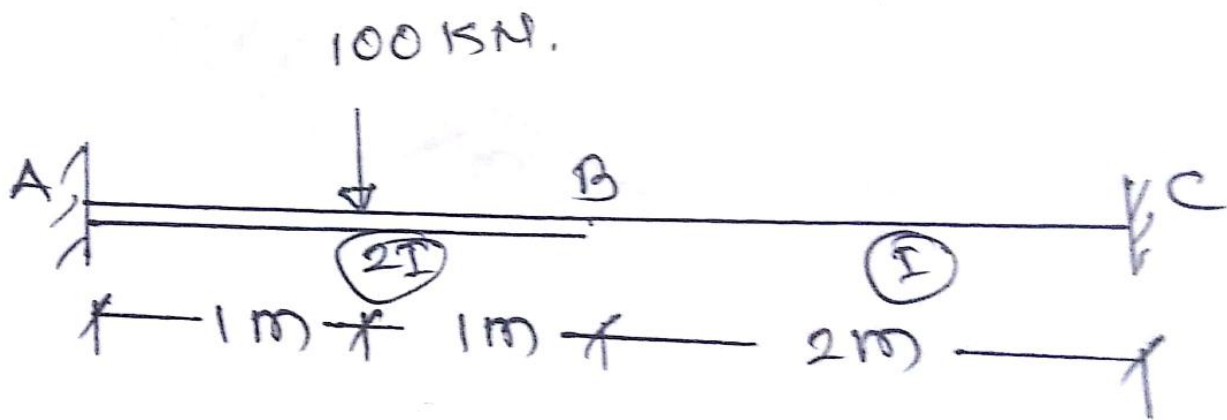
Q.4 Analyse the frame by stiffness matrix method.

20



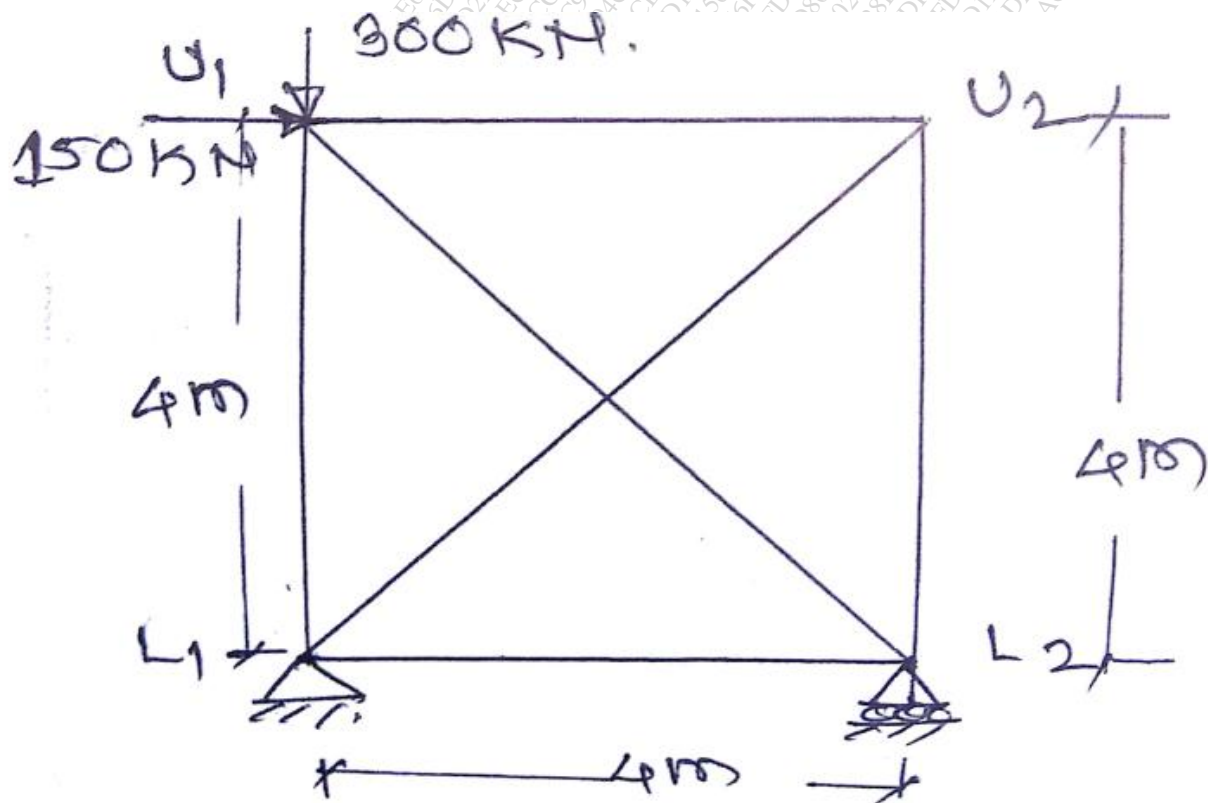
Q.5 a) Analyse the beam by stiffness matrix method.

10



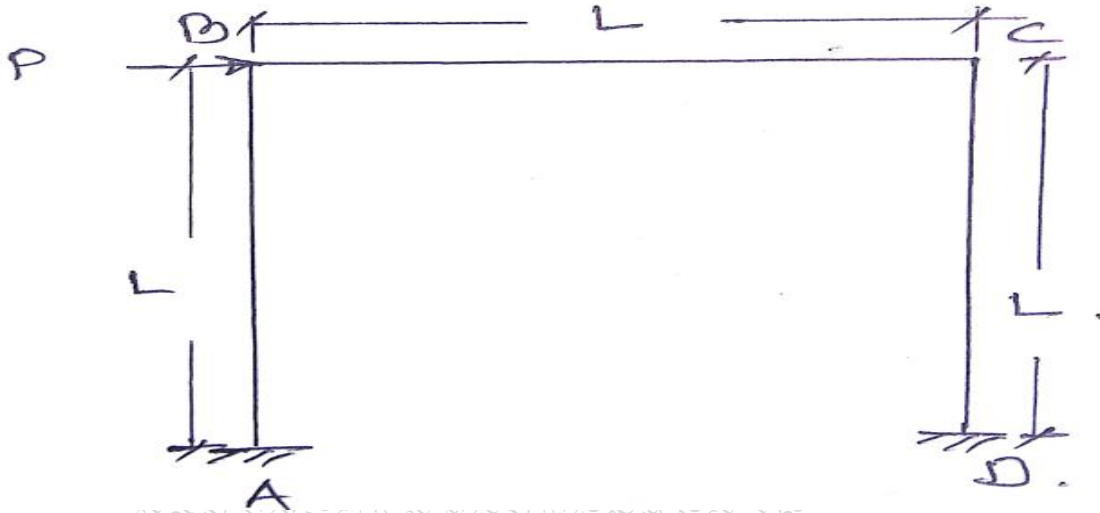
b) Analyse the pin jointed truss as shown in fig. The axial stiffness of each member is  $100 \text{ kN/m}$ .

10





Q.6 Analyse the portal frame as shown in fig. by stiffness matrix method. Draw Bending moment diagram. 20  
Neglect axial displacements of the column. Take  $EI$  is constant.



Total No. of Printed Pages:2

**SUBJECT CODE NO:- E-8011**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Advanced Machine Design**  
**(Revised)**

**[Time: Three Hours]**

**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
- (i) Question no.1 from section A and Question no.6 from section B are compulsory.
  - (ii) Solve any two questions from the remaining in each section.
  - (iii) Figure to right indicate full marks.
  - (iv) Assume suitable data if required and state it clearly.

**Section A**

- Q.1 Attempt any two from the following. 16
- a) Explain Mohr's circle for tri-axial state of stresses
  - b) Explain flat disc spring theory
  - c) What are the features, merits, demerits and applications for Belleville spring?
- Q.2 How principal stresses are computed from principal strains? 12
- Q.3 Explain principal strains due to perpendicular stresses and shear stresses. 12
- Q.4 A steel Belleville spring has the ratio  $h/t = 1.5$  and the ratio of maximum diameter to minimum diameter is 2. The thickness of the disc is 6.25 mm. The stress induced in spring material is 1185 Mpa when it is compressed flat. Find the load P and minimum and maximum radii. Find the possible stress the spring can sustain and corresponding load P. 12
- Q.5 What are the advantages and disadvantages of square section helical compression spring, ring spring Belleville spring and Torsion bar spring over Round bar spring? 12

**Section – B**

- Q.6 Attempt any two from the following. 16
- a) Explain fracture mechanism approach to design.
  - b) Explain the philosophy of computer aided machine design.
  - c) Explain design of spring through interactive programming.

Q.7 If the equation for polynomial cam is  $y = C_a + C_1 + C_2x^2 + C_3x^3 + C_4x^4 + C_5x^5$ . 12

Find the values of constants for the boundary conditions.

When  $x = 0$ ,  $y=h$ ,  $y'=0$

When  $x=1$ ,  $y = y'=y''=y'''=0$

Compute and plot values of  $y/h$ ,  $y'/h$ ,  $y''/h$ ,  $y'''/h$  at intervals of  $x=0.3$ .

Q.8 A cam rotates at 600 rpm and has total lift of 100 mm with D-R-D type motion. Find the displacement, velocity and acceleration after  $30^\circ$  of cam rotation, if the motion of follower is SHM. 12

Q.9 Explain the term Polynomial Cam. Derive an equation for 3-4-5 polynomial (D-R-D) cam and show that it gives the best result 12

Q.10 Write a short note on – 12

- a) Undercutting of Cam
- b) Causes and interpretation of failure

**SUBJECT CODE NO: E-8028**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Advanced Manufacturing Techniques**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B 1. Q.No.1 from section A and Q.No.5 from section B are compulsory.  
 2. Solve any two questions from Q.No.2 to Q.No.4 in Sec-A and any two questions from Q.No.6 to Q.No.8 Sec-B.

**Section -A**

- Q.1 Solve any three questions of the following. 18  
 a. Explain Flask Less Moulding.  
 b. What do you understand by Rapid prototype patterns?  
 c. With specific example explain the precision grinding.  
 d. Comment on Tool Chip Interface Friction.
- Q.2 a. What do you mean by web based collaboration? 06  
 b. Discuss in detail uniformity in casting and moulding. 05
- Q.3 a. What do you mean by Benchmarking of RP and T Routes for casting application? 06  
 b. Enlist various types of Tool Wear and explain any one. 05
- Q.4 a. With specific example explain the surface finish operation. 06  
 b. Comment on Heat Generation during Metal Cutting Process. 05

**Section -B**

- Q.5 Solve any three questions of the following. 18  
 a. Discuss the significance of Non-Traditional Manufacturing Process compared to traditional process.  
 b. Explain Magneto Abrasive Finishing Process in detail.  
 c. Explain with neat sketch compression Molding Process and state its application.  
 d. Enlist the products formed by injection moulding and explain any one in detail.
- Q.6 a. Explain Electro Stream Drilling with specific example. 06  
 b. With specific example explain the areas of Application for Thermal Spray Coating. 05
- Q.7 a. Explain in detail importance and principle application of chemical vapour deposition. 06  
 b. What do you mean by structural foam molding? 05
- Q.8 a. Enlist suitable application of Thermo Forming process and explain in detail. 06  
 b. Suggest a suitable process for microdrilling Holes in Thin Sheets and explain in detail. 05

**SUBJECT CODE NO:- E-8048**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Engineering Experimental Technique**  
**(Revised)**

**[Time: Three Hours]**

**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
1. Solve any three questions from each section.
  2. Figures to the right indicate full marks.
  3. Assume suitable data, if necessary.
  4. Use of non-programmable calculator is allowed.

**Section -A**

- Q.1 a. Explain the concept of generalized measurement systems. 06
- b. A certain thermometer has a time constant of 15s and an initial temperature of 20<sup>0</sup>C. It is suddenly exposed to a temperature of 100<sup>0</sup>C. Determine the rise time, that is, the time to attain 90 percent of the steady-state value, and the temperature at this time. 07
- Q.2 a. What is meant by zeroth-,first-, and second-order systems? 07
- b. What is a fixed error; random error? 06
- Q.3 a. What is meant by level of significance; level of confidence? 06
- b. Two resistors  $R_1$  and  $R_2$  are connected in series and parallel. The values of the resistances are  
 $R_1 = 100.0 \pm 0.1\Omega$   
 $R_2 = 50.0 \pm 0.03\Omega$   
Calculate the uncertainty in the combined resistance for both the series and the parallel arrangements. 07
- Q.4 Write short notes on: (any two) 14
- i. Chi-square test
  - ii. Graphical analysis & curve fitting
  - iii. Regression analysis
  - iv. Least-squares analysis
  - v. Impedance matching



## Section -B

- Q.5      a. What are the practical considerations of seismic instruments? 07  
            b. How are elastic elements used for force or torque measurements? 06
- Q.6      a. Define the sound –absorption coefficient, noise-reduction coefficient (NRC). Explain how is a 08  
            sound-level meter calibrated?  
            b. What are the main advantages of a semiconductor strain gauge? 05
- Q.7      a. What is meant by “aliasing”? How may it be alleviated? 07  
            b. Explain any two types of strain gauges. 06
- Q.8 Write short notes on: (any two) 14
- i.        Signal Conditioning
  - ii.       Data storage & display
  - iii.      The program as substitute for wired logic
  - iv.      Sound measurement
  - v.        Analog to digital and digital to analog conversion

**SUBJECT CODE NO: E-8070**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Elective-III: Finite Elements Methods**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

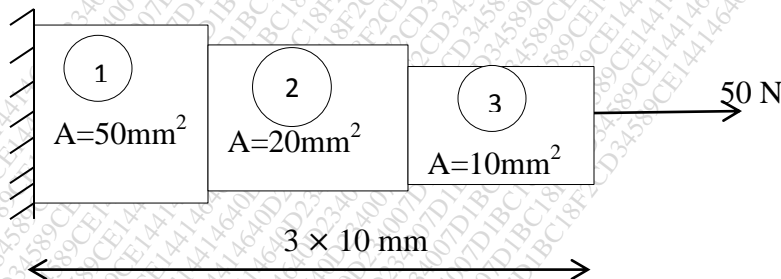
Please check whether you have got the right question paper.

N.B

- 1) Q.1 & Q.6 are compulsory.
- 2) All questions are compulsory.
- 3) Assume suitable data, if necessary.

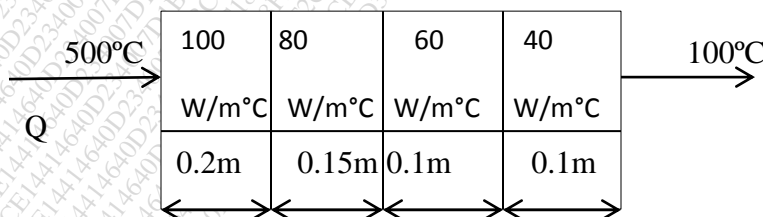
**Section A**

- Q.1 a) Explain weighted residual approaches. 04
- b) What are the advantages & disadvantages of FEM? 03
- c) Explain natural co-ordinate system. 03
- d) Explain patch test. 04
- Q.2 Solve the problems as shown in fig. Calculate displacement of stresses in each element. 13
- Take  $E = 200 \times 10^3 \text{ N/mm}^2$



**OR**

- Q.3 Calculate inter-mediate temp for steady state heat transfer. 13



Q.4 Explain variational & Weighted approaches with example. 13

**OR**

Q.5 Write short notes on

- a) Application of plane stress & strain
- b) Structural stability

07

06

**Section B**

Q.6 a) Explain numerical techniques? 04

b) What is mean by idealisation of stiffness in beam elements. 03

c) How are the data collection in FEM? 03

d) Explain structural stability. 04

Q.7 Discuss 'FEM as essential component of CAD'. 13

**OR**

Q.8 Explain use of different commercial FEM packages. 13

Q.9 Explain applications of the method to materially non-linear problems with suitable examples. 13

**OR**

Q.10 Write short notes on :-

a) Data collection & mesh Generation.

07

b) Conventional analysis.

06

**SUBJECT CODE NO: E – 8071**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Elective-III: Computer Aided Design**  
**(Revised)**

**[Time: Three Hours]**

**[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B i. Answer any three questions from each section.

**Section A**

- Q.1 What is the importance of design? Explain in detail. 13
- Q.2 Explain CAD system architecture in detail. 13
- Q.3 Write about the Capabilities and modules of CATIA. 13
- Q.4 What is Concatenated representation? Explain. 13
- Q.5 Write about UG/ NX modelling software in detail. 14

**Section B**

- Q.6 Write about the data exchange standard IGES in detail. 13
- Q.7 What in Sweep representation? Explain with examples. 13
- Q.8 What are surface modes? Explain. 13
- Q.9 What is knowledge based Engineering? Explain. 13
- Q.10 What is tolerance modelling? Explain. 14

**SUBJECT CODE NO: E – 8110**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Elective-IV: Mechanical Vibrations**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- Solve any three questions from each section.
  - Assume suitable data, if required.

**Section A**

- Q.1
- Explain the various effect of vibration. 04
  - A circular cylinder of mass 4kg & radius 150mm. is connected by a spring of stiffness' 4000 N/M. as shown in fig 01 it is free to roll on horizontal rough. Surface without slipping determine the natural frequency. 10

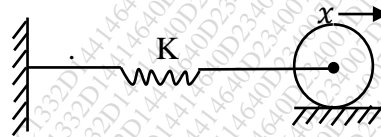


Fig. 01

- Q.2
- Define & explain damping factor, damping coefficient and logarithmic decrements. 04
  - A gun barrel having mass 560kg designed with the following data. 09  
 Initial recoil velocity 36 m/s  
 Recoil distance on firing 1.5m calculate  
    - Spring constant
    - Damping coefficient and
    - Time required for the barrel to return to a position 0.12m from its initial position.

- Q.3 Derive the equation of motion for the system shown in fig 02 13

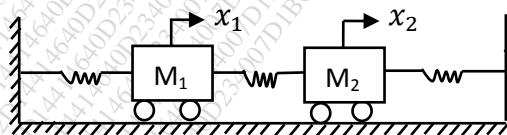


Fig 02

- Q.4 Determine the natural frequencies and mode shape for the system shown in fig – 03. 13

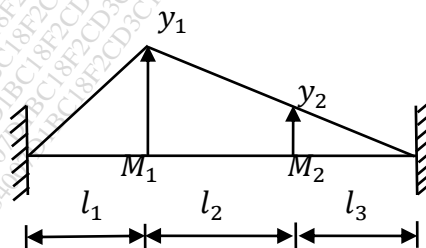


Fig 03



- Q.5 Write short note on (any two) 13
- Dry friction damper
  - Centrifugal pendulum absorber
  - Force & motion transmissibility

### Section B

- Q.6 Explain the Stodola method. 14
- Q.7 Find the fundamental natural frequency & corresponding mode shape for the system shown in fig – 13 04. By using matrix iteration. Also obtain higher mode by applying the principle of orthogonality.

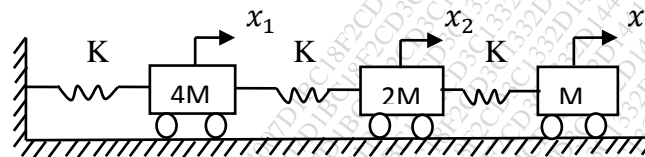


Fig. 04

- Q.8 Derive differential equation longitudinal vibration of bar in continuous systems. 13
- Q.9 Explain the phase plane method to solve transient vibration. 13
- Q.10 A non-linear spring for a single degree of freedom system is given.  $K(x) = 10x + 2000x^3$  C for viscous damping is 1.5 kg/sec/cm. A harmonic force 5 kg amplitude Acts on the mass = 1 kg find the steady state response using the direct interaction method. 13

Total No. of Printed Pages:2

**SUBJECT CODE NO: E-8111**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Elective-IV: Computer Integrated Manufacturing**  
**(Revised)**

**[Time: Three Hours]**

**[Max.Marks:80]**

- N.B Please check whether you have got the right question paper.
- Attempt any three questions from each section.
  - Draw neat sketches wherever required
  - Assume additional data if necessary

**Section A**

- Q.1 a) What do you understand by CIM? Describe with a sketch. 07
- b) Describe islands of automation in the context of CIM. 06
- Q.2 a) What is Group-Technology? Explain its relevance with CIM. 07
- b) What is meant by cellular manufacturing? 06
- Q.3 a) Describe Generative approach of CAPP 07
- b) What is role of process planning in integration of CAD/CAM? 06
- Q.4 a) What is barcode technology? How is it useful for shop floor control? 07
- b) What is manufacturing automation protocol? 06
- Q.5 Write notes on (Any two) 14
- OPTIZ
  - FMS
  - Dedicated and Open system

**Section B**

- Q.6 a) Describe system modelling tools. 07
- b) Describe manufacturing Enterprise wheel with a sketch 06

- Q.7 a) What is LAN? Describe LAN topology. 07
- b) What do you understand network management with reference to CIM implementation? 06
- Q.8 a) What is MAP & TOP? 07
- b) What is RDBMS? Which are database operates? 06
- Q.9 a) What do you understand by Material Handling system? What is its relation with CIM? 07
- b) What is carousal? How is it related to CIM? 06
- Q.10 Write notes on (any two) 14
- a) CIMOSA
- b) Automated data collection
- c) IDEF models

**SUBJECT CODE NO: E-8112**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Elective-IV: Refrigeration & Cryogenic Systems**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Answer any three questions from each section.
  - ii) Use of refrigerants properties table and steam table is / are allowed.
  - iii) Figures to the right indicate full marks.
  - iv) Assume suitable data, if required

**Section A**

- Q.1 A two stage compression machine with a flash intercooler is to produce 25 tons of Refrigeration while working between  $-30^{\circ}\text{C}$  to  $42^{\circ}\text{C}$ . The pressure in the flash Intercooler is the geometric mean of lower and upper pressure limits. Sketch the system and cycle on the p-h diagram giving relevant property values. The enthalpy at the end of LP compressor is  $195\text{kJ/kg}$  and that of HP compressor is  $211.1\text{kJ/kg}$ . The working Medium is R-12. Find 13
- i) COP
  - ii) Power,
  - iii) Fluid flow through LP and HP Compressors,
  - iv) Volume handled by LP compressor.
- Q.2 The following values refer to a Li-Br water system. Condensing temperature is 303 K, Evaporator temperature is 278 K, Absorber temperature is 303 K and generator Temperature is 353 K. Locate the state points on Li-Br-water h-c chart and obtain the C.O.P. of the system. Compare the C.O.P with ideal value. Specific gravity of the weak Solution is 1.57. 13
- Q.3 a) Explain the concept of 'ODP' & 'GWP' with suitable examples. 07
- b) Write short note on 'Secondary refrigerants & alternative refrigerants. 06
- Q.4 A single compressor using R-12 as refrigerant has three evaporators of capacity 30 TR, 20 TR and 10 TR. The temperature in the three evaporators is to be maintained At  $-10^{\circ}\text{C}$ ,  $5^{\circ}\text{C}$  &  $10^{\circ}\text{C}$  respectively. The system is provided with multiple expansion Values & back pressure values. The condenser temperature is  $40^{\circ}\text{C}$ . The liquid Refrigerant leaving the condenser is sub cooled to  $30^{\circ}\text{C}$ . The vapours leaving Evaporator are dry and saturated. Assuming isentropic compression, find 13
- 1) The mass of refrigerant flowing through each evaporator;
  - 2) The power required to drive the compressor;
  - 3) The C.O.P. of system.

- Q.5 Write short notes on the following :- 14
- Magnetic refrigeration
  - Thermo-acoustic refrigeration

### Section B

- Q.6 a) Calculate the ideal work requirement for liquefaction of Helium and Hydrogen Beginning at 1 bar pressure and 300 K. Compare the results. 07
- b) Explain briefly 'Carnot liquefaction system'. 06
- Q.7 a) Explain the importance of Joule Thompson coefficient and inversion temperature When operating a system for liquefaction of gases. 07
- b) Explain the 'Kapitza System'. 06
- Q.8 Describe with neat sketches working of 13
- Shell and coil condenser
  - Shell and tube condenser.
- Q.9 a) What problems does the lubricating oil cause in the evaporator? 07
- b) Compare scroll compressor with screw compressor. 06
- Q.10 Write short notes on the following. 14
- Super conductivity applications of cryogenics
  - Yield of liquefaction system.



**SUBJECT CODE NO: E – 8141**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Manufacturing Engg.) Examination Nov/Dec 2017**  
**Advanced Machining Science**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i. Solve any three questions from each section.
  - ii. Assume suitable data if required.
  - iii. Draw neat sketch wherever required.
  - iv. Figures to right indicate full marks.

**Section A**

- Q.1 How theory of Merchant has help in estimating forces during machining explain with neat sketch. 13
- Q.2 What is tool wear? Explain the types of wear and also mechanism of tool wear. 13
- Q.3 What are property requirement of tool materials? Explain CBN and ceramic tool material in detail. 13
- Q.4 Write short note on any two. 14
- i) Effect of tool geometry
  - ii) Tool coating
  - iii) Economics of machining.

**Section B**

- Q.5 a) Explain the term modeling of machining characteristics in grinding. 07  
b) What is high speed machining? Explain. 06
- Q.6 With neat sketch explain ECM process also state and explain the factors affecting the process. 13
- Q.7 a) How cutting force measurement is done? Explain. 07  
b) How micro – drilling is carried out? Explain. 06
- Q.8 Write short note on any two. 14
- i) Nano surface generation
  - ii) Chip formation
  - iii) Heat and temperature distribution in metal cutting.

**SUBJECT CODE NO: E-8150**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical) Examination Nov/Dec 2017**  
**Advanced Optimization Techniques**  
**(Revised)**

**[Time: Three Hours]**

**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
- i) Solve any Three questions from each section.
  - ii) Figure to right indicates full marks.
  - iii) Assume suitable data if required and state it clearly.
  - iv) Use of non-programmable calculator is allowed.

**Section A**

- |     |   |    |
|-----|---|----|
| Q.1 | Use Fibonacci search method to solve<br>Minimize $f(x) = x^2 + 54/x$ within bound (0,5)   | 13 |
| Q.2 | Find the minimum of $f = x(x-3/2)$ by starting from 0.0 with an initial step size of 0.05<br>Using exhaustive search method.  | 13 |
| Q.3 | Write down K-T condition for NLP problem. Check whether the points are K-T points.<br>Minimize $f(x) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2$<br>Subject to,<br>$g_1(x) = 26 - (x_1 - 5)^2 - x_2 \geq 0$<br>$g_2(x) = 20 - 4x_1 - x_2 \geq 0$<br>$x_1, x_2 \geq 0$<br>The point are $(1, 5)^T, (3, 2)^T$ | 13 |
| Q.4 | Minimize $f(x) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $X_1 = \{0\}$ using<br>Cauchy method.  | 13 |
| Q.5 | Write a short note on- ( <u>Any Two</u> )<br>a) Constrained optimization<br>b) Optimality Criteria<br>c) Single variable optimization.  | 14 |

## Section –B

- Q.6 A farmer has a 100 acre farm. He can sell all the tomatoes, lettuce or radishes he can raise. The price he can obtain is Rs 1 per kg for tomatoes, Rs 0.75 a head for lettuce and Rs 2 per kg for radishes. The average yield per acre is 2000 kg for tomatoes, 3000 heads of lettuce and 1000 kg of radishes. Fertilizer is available at Rs 0.50 per kg and the amount required per acre is 100 kg each for tomatoes and lettuce and 50 kg for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man days for tomatoes and radishes and 6 man days for lettuce. A total of 400 man days of labour are available at Rs. 20 per man day. Solve the problem for maximization of farmer's profit. 13
- Q.7 Maximize  $Z = 5x_1 + 7x_2$   
 Subjected to,  
 $-2x_1 + 3x_2 \leq 6$   
 $6x_1 + x_2 \leq 30$   
 $x_1, x_2 \geq 0$  and integer  
 Solve using cutting plane (Gomory's) method. 13
- Q.8 Use two phase simplex method to  
 Maximize  $Z = 3x_1 + 2x_2 + 2x_3$   
 Subjected to,  
 $5x_1 + 7x_2 + 4x_3 \leq 7$   
 $-4x_1 + 7x_2 + 5x_3 \geq -2$   
 $3x_1 + 4x_2 - 6x_3 \geq \frac{29}{7}; x_1, x_2, x_3 \geq 0$  13
- Q.9 a) What is genetic algorithm? 07  
 b) Describe simulated annealing. 06
- Q.10 Write a short note on- (Any Two) 14  
 a) Global optimization  
 b) Sensitivity Analysis for NIP  
 c) Simplex Algorithm

Total No. of Printed Pages:1

**SUBJECT CODE NO:- E – 8184**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical-Heat Power) Examination Nov/Dec 2017**  
**Advanced Fluid Mechanics**  
**(Revised)**

**[Time: Three Hours]**

**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
1. Solve any three questions from each section.
  2. Figure to right indicates marks.
  3. Assume suitable data whenever required.
  4. Draw figure whenever required.

**Section A**

- |     |   |    |
|-----|---|----|
| Q.1 | a) Explain conservation of mass & conservation of momentum.   | 06 |
|     | b) Derive Euler's equation of motion.   | 07 |
| Q.2 | a) Explain momentum & energy correction factor.   | 06 |
|     | b) Explain relation between stress & rate of stress tensor.   | 07 |
| Q.3 | Show that in case of a couette flow, the shear stress at a horizontal mid plane of channel is independent of pressure gradient imposed on the flow. | 13 |
| Q.4 | Write a note on any two.  | 14 |
|     | a) Normal & oblique shock   |    |
|     | b) Couette flow   |    |
|     | c) Plane poiseuille flow  |    |

**Section B**

- |     |   |    |
|-----|---|----|
| Q.5 | Derive & explain navier – stokes equation of motion.  | 13 |
| Q.6 | Derive continuity equation in cylindrical polar co – ordinate system for incompressible flow. | 13 |
| Q.7 | a) Explain boundary layer separation & its control.   | 07 |
|     | b) Explain boundary layer definition & characteristics.                                       | 06 |
| Q.8 | Write a note on any two.  | 14 |
|     | a) Laminar & Turbulent boundary layer   |    |
|     | b) Normal shock equation  |    |
|     | c) Ideal & non ideal flows.   |    |

**SUBJECT CODE NO: E-8146**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (CAD/CAM) Examination Nov/Dec 2017**  
**Advanced Machine Design**  
**(Revised)**

[Time: 3 Hours]

[Max.Marks:80]

N.B Please check whether you have got the right question paper.

- i. Solve any three questions from each section.
- ii. Figure to right indicate full marks.
- iii. Assume suitable data if required and state it clearly.

**Section A**

- |     |   |          |
|-----|---|----------|
| Q.1 | a) Show that the cross shears are equal.<br>b) Explain state of strain at a point.  | 07<br>06 |
| Q.2 | a) What is plane strain condition? Explain with suitable examples.<br>b) What do you understand by axisymmetric analysis?   | 07<br>06 |
| Q.3 | a) State and explain Love-Kirchhoff's theory for analysis of plate.<br>b) Write the differential equation of deflection of simple supported plate subjected to transverse load. State the simple supported boundary conditions. At which locations the deflection is maximum. | 06<br>07 |
| Q.4 | a) Explain the central difference method for solution of dynamic problem of single degree of freedom.<br>b) Compare the direct integration methods and mode super position methods.   | 07<br>06 |
| Q.5 | Write short note on(Any Two)<br>a) Forced method<br>b) Laminated composite plate<br>c) Implicit scheme  | 14       |

**Section B**

- |      |   |          |
|------|---|----------|
| Q.6  | a) Explain surface energy.<br>b) Explain stable and unstable crack growth.  | 06<br>07 |
| Q.7  | a) Explain different kinds of failure.<br>b) What is ductile fracture? Explain with suitable example.   | 07<br>06 |
| Q.8  | a) What are different mechanisms of an elastic deformation in a polymer?<br>b) What are important requirement of a slip gauge?                                      | 07<br>06 |
| Q.9  | a) Determine GI for DCB specimen with a load at the end of cantilever considering stain energy of shear force.<br>b) Why are charpy test still popular in industry? | 07<br>06 |
| Q.10 | Write a short note on- (Any Two)<br>a) KIC test technique<br>b) Measurement of crack length<br>c) The subspace iteration scheme.                                    | 14       |



Total No. of Printed Pages:3

**SUBJECT CODE NO: E-8151**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical Design Eng.) Examination Nov/Dec 2017**  
**Computational Techniques in Design Engineering**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- Attempt any three questions from section 'A' and any three questions from section 'B'.
  - Assume suitable data, if necessary.
  - Use of non – programmable Calculator is permitted.
  - Figures to the right indicate full marks.

**SECTION 'A'**

- Q.1 Find  $f(22)$  from the Gauss forward formula 13

|      |     |     |     |     |     |     |
|------|-----|-----|-----|-----|-----|-----|
| X    | 20  | 25  | 30  | 35  | 40  | 45  |
| f(x) | 354 | 332 | 291 | 260 | 231 | 204 |

- Q.2 (a) Find a least squares fit of the form  $y = a_0 + a_1x^2$  to the following data: 06

|    |    |   |   |   |
|----|----|---|---|---|
| X: | -1 | 0 | 1 | 2 |
| Y: | 2  | 5 | 3 | 0 |

- (b) Fit the straight line to the following data: 07

|    |   |   |   |   |   |   |   |   |    |
|----|---|---|---|---|---|---|---|---|----|
| X: | 6 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 |
| Y: | 5 | 5 | 4 | 5 | 4 | 3 | 4 | 3 | 3  |

- Q.3 Obtain using Jacobi's method, all the eigenvectors of the matrix. 13

$$A = \begin{bmatrix} 1 & 1 & 0.5 \\ 1 & 1 & 0.25 \\ 0.5 & 0.25 & 2 \end{bmatrix}$$

- Q.4 a) Compute the value of 07

$$\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$$

Using Simpson's 3/8 the rule.

- b) Evaluate  $\int_{-1}^1 \frac{dx}{1+x^2}$  using Gauss formula for  $n = 2$  and  $n = 3$  06

Q.5 Write short notes on following (any three)

a) Sterling formula

05

b) Bessel's formula

04

c) Errors in numerical computations

05

d) Cubic splines

04

e) Weighted least square methods.

04

### SECTION 'B'

Q.6 Using Runge –Kutta method of fourth order solve for y at x = 1.2, 1.4 from

13

$$\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + xe^x} \quad \text{given } x_0 = 1, y_0 = 0.$$

Q.7 a) Solve  $y_{n+2} - 2\cos\alpha y_{n+1} + y_n = \cos\alpha n$

07

b) Solve  $y_{n+2} - 4y_n = n^2 + n - 1$

06

Q.8 Solve the elliptic equation  $u_{xx} + u_{yy} = 0$  for the following square mesh with boundary as shown in fig(1)

13

|      |   |         |      |         |         |      |
|------|---|---------|------|---------|---------|------|
|      | 0 | 500     | 1000 | 500     | 0       |      |
| 1000 |   | $\mu_1$ | C    | $\mu_2$ | $\mu_3$ | 1000 |
| A    |   | $\mu_4$ |      | $\mu_5$ | $\mu_6$ | B    |
| 2000 |   |         |      |         |         | 2000 |
|      |   | $\mu_7$ |      | $\mu_8$ | $\mu_9$ |      |
| 1000 |   |         | D    |         |         | 1000 |
|      | 0 | 500     | 1000 | 500     | 0       |      |

Fig. 1

Q.9 (a) Explain Hyperbolic equations.

06

(b) Discuss rules for finding out complementary functions.

07

Q.10 Write short notes on following questions.(any three)

a) Picard's method.

04

b) Poisson's equation.

05

c) Linear difference equation.

05

d) Application to deflection of a loaded spring.

04

e) Rules for finding Particular integral.

04

**SUBJECT CODE NO:- E-8147**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**M.E. (Mechanical-Heat Power) Examination Nov/Dec 2017**  
**Computational Mathematics**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

N.B

Please check whether you have got the right question paper.

- 1) Q.No. 5 from Section A and Q.No. 10 from Section B are compulsory.
- 2) Attempt any two questions from Q.No.1 to Q.No.4.
- 3) Attempt any two questions from Q.No. 6 to Q.No. 9
- 4) Assume suitable data if necessary.
- 5) All notations have their usual meaning.

## Section A

- Q.1 a) Solve the equations; 10
- $$10x_1 - 2x_2 - x_3 - x_4 = 3, -2x_1 + 10x_2 - x_3 - x_4 = 15, -x_1 - x_2 + 10x_3 - 2x_4 = 27,$$
- $$-x_1 - x_2 - 2x_3 + 10x_4 = -9 \quad \text{by Gauss- Seidal iteration method.}$$
- b) Write a computer program for the above problem. 06
- Q.2 a) Why numerical methods have become so important in engineering practice. 06
- b) Solve by Jacobi's iteration method, the equations; 10
- $$20x + y - 2z = 17, \quad 3x + 20y - z = -18, \quad 2x - 3y + 20z = 25$$
- Q.3 a) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by using Simpson's  $\frac{1}{3}$  rule. 10
- b) Write a computer program for above problem. 06
- Q.4 What is meant by closed and open form of Newton-Cotes formula? Derive the Simpson's rule. 16
- Q.5 Write short notes on (any two) 08
- a) Newton-Cotes Quadrature formula
  - b) Unconstrained Optimization
  - c) Shooting Method

## Section B

- Q.6 Give the values of the  $u(x, y)$  on the boundary of the square in the figure (a) below, evaluate the 16 function  $u(x, y)$  satisfying the Laplace equation  $\nabla^2 u = 0$  at the pivoted points of this figure by Jacobi's method.

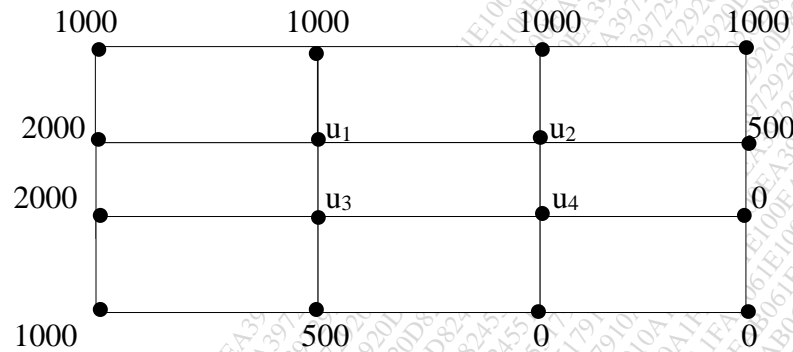


Fig ( a )

- Q.7 Explain the solution to the heat conduction equation by using 16
- Explicit Method
  - Crank Nickelson Method
- Q.8 a) Explain hyperbolic partial differential equation in details. 06  
b) The following data was calculated from the equation  $y = 5 + 4x_1 - 3x_2$  10

| $x_1$ | $x_2$ | $y$ |
|-------|-------|-----|
| 0     | 0     | 5   |
| 2     | 1     | 10  |
| 2.5   | 2     | 9   |
| 1     | 3     | 0   |
| 4     | 6     | 3   |
| 7     | 2     | 27  |

Use multiple linear regression to fit this data.

- Q.9 Fit the function  $f(x; a_0, a_1) = a_0 (1 - e^{-a_1 x})$  to the data: 16

| X | 0.25 | 0.75 | 1.25 | 1.75 | 2.25 |
|---|------|------|------|------|------|
| Y | 0.28 | 0.57 | 0.68 | 0.74 | 0.79 |

Use initial guesses of  $a_0 = 1.0$  and  $a_1 = 1.0$  for the parameters.

Assume that for these guesses, the initial sum of the square of the residuals is 0.0248

- Q.10 a) Explain the stability and convergence criteria in detail. 04  
b) Explain multiple regression method in detail. 04