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**F.Y. B.Tech. (Mechanical Engineering) (CBCS)**  
**(Semester - VIII) Examination, March - 2023**  
**INDUSTRIAL AUTOMATION AND ROBOTICS (Elective - IV)**  
**Sub. Code : 84853**

Day and Date : Saturday, 24 - 06 - 2023

Total Marks : 70

Time : 10.30 a.m. to 01.00 p.m.

- Instructions :
- 1) All Questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Make suitable assumptions wherever necessary and state them clearly.
  - 4) Use of statistical tables and scientific calculator is permitted.

**Q1) Solve any one.**

- a) What is Industrial Automation? What are the reasons why industries automate their operations? [7]
- b) Describe the low cost automation with example and its advantages. [7]

**Q2) Solve any two.**

- a) Differentiate between Process Industries and Discrete Manufacturing Industries. [7]
- b) Write short note on analysis of transfer line without storage buffer. [7]
- c) Give common reasons for downtime on an automated production line and explain each one briefly. [7]

**Q3) Solve any two.**

- a) What are the different types of vibratory and non vibratory part feeder mechanisms in automated assembly? [7]
- b) Explain the following parts in assembly automation. [7]
  - i) Hoppers
  - ii) Orientation mechanism
- c) What are the reasons of the existence of partially automated production line? [7]

**P.T.O.**

Q4) Solve any one.

- a) Describe the power transmission system in robots. [7]
- b) What are the specifications are to be considered at the time of selection of robot? [7]

Q5) Solve any two.

- a) Explain the remote centre compliance device in robot assembly. [7]
- b) Explain the factors to be considered in design and selection of gripper. [7]
- c) Write short note on the force and torque sensors. [7]

Q6) Solve any two.

- a) Explain a robot program as a path in space. [7]
- b) Write short note on VAL II. [7]
- c) What is the application of robot in processing industry? [7]

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**Fourth Year B.Tech. (Mechanical Engineering) (CBCS)**  
**(Semester - VIII) Examination, March - 2023**  
**ENERGY & POWER ENGINEERING**  
**Sub. Code : 84844**

**Day and Date : Saturday, 17 - 06 - 2023**  
**Time : 10.30 a.m. to 1.00 p.m.**

**Total Marks : 70**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Make suitable assumptions wherever necessary and state them clearly.
  - 4) Use of statistical tables and scientific calculator is permitted.

**Q1) Solve any two.**

- a) Compare cyclindrical parabolic and concentrating paraboloid solar collector on the basis of [6]
  - i) Temperature
  - ii) Concentration ratio
  - iii) Suitability
  - iv) Expected life
  - v) Cost
  - vi) Construction
- b) Outline the need of thermal energy storage and list the types. [6]
- c) State and explain solar thermal application. [6]

**Q2) Solve any two.**

- a) Give different applications of PV cells. [6]
- b) Explain with neat sketch working of fuel cell and list advantages of the fuel cell. [6]
- c) With the help of block diagram explain the operation of standalone solar power generation system with battery and AC load. [6]

**P.T.O.**



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Q3) a) Explain the concept of hybrid wind-PV power plant. State their advantages. [5]

b) Discuss the working principle of closed cycle OTEC plant with neat sketch. Write their advantages and disadvantages. [6]

Q4) Solve any two.

a) Write advantages and disadvantages of combined power cycle. [6]

b) Explain in detail factors considered for the selection of site for hydroelectric power plant. [6]

c) Explain the Thermal power plant with neat sketch. [6]

Q5) Solve any two

a) Explain the radiation pyrometer with neat sketch. [6]

b) The peak load on a power station is 30 MW. The loads having maximum demands of 25MW, 10MW, 5MW and 7MW are connected to the power station. The capacity of the power station is 40MW and annual load factor is 50% find [6]

i) Average load on the power station.

ii) Energy supplied per year

iii) Demand Factor

c) Draw and discuss the load curves for the following types of load [6]

i) Residential load.

ii) Industrial load.

iii) Commercial load.

Q6) a) Write short note on supply chain in power sector. [5]

b) Explain the process of energy audit in a commercial establishment. [6]



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Total No. of Pages: 2

### Summer Examination March - 2023

Subject Name: Bachelor of Engineering 79121\_63362 79121\_79409 - Fluid and Turbo Machinery\_19.06.2023\_10.30 AM To 01.00 PM  
Subject Code: 79121

Day and Date: - Monday, 19-06-2023  
Time: - 10:30 am to 01:00 pm

Total Marks: 70

**Instructions.:**

- 1) Figures to the right indicate full marks
- 2) Use of Scientific calculator is allowed
- 3) Assume suitable data wherever necessary and mention it boldly

**Special Instruction.:**

Que. No. 4 and Que. No. 8 are Compulsory. Attempt any Two questions from Que. No. 1, 2 and 3. Attempt any Two questions from Que. No. 5, 6 and 7.

- 
- Q.1. Attempt the following questions [10]  
a) Explain construction & working of Pelton wheel turbine  
b) Explain governing of pelton wheel turbine
- Q.2. Attempt the following questions [10]  
a) Explain difference between Impulse and Reaction turbine  
b) Explain construction & working of Kaplan turbine
- Q.3. Attempt the following questions [10]  
a) Explain different efficiencies of centrifugal pump  
b) Explain multistage of centrifugal pump
- Q.4. Attempt the following questions (Any Two) [16]  
a) A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a pelton wheel and the jet is deflected through an angle of  $165^\circ$  by the buckets. The head available at the nozzle is 400 m. Assuming co-efficient of velocity as 0.97, speed ratio as 0.46, and reduction in relative velocity while passing through buckets as 15%, find:  
(i) The force exerted by the jet on buckets in tangential direction,  
(ii) The power developed.  
(iii) Also draw velocity triangle diagram
- b) A Francis turbine with overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity =  $0.26 \sqrt{2gH}$  and radial velocity of flow at inlet is  $0.96 \sqrt{2gH}$ . The wheels runs at 150 r.p.m. and hydraulic losses in turbine are 22% of available energy. Assuming radial discharge,  
Determine:  
i) Guide blade angle,                      ii) Wheel vane angle,  
iii) Diameter of wheel,                      iv) Width of wheel at inlet
- c) A centrifugal pump is running at speed 1550 rpm and discharge is  $0.220 \text{ m}^3/\text{s}$  against a head of 27 m. The impeller diameter is 300mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller



Q.5. Attempt the following questions

[10]

- a) Write short note on the necessity of multistaging in compressor.
- b) Derive the expression for workdone by single stage reciprocating air compressor without clearance volume during polytropic compression.

Q.6. Attempt the following questions

[10]

- a) Compare between reciprocating and centrifugal compressor
- b) Explain the concept of Surging, choking & stalling

Q.7. Attempt the following questions

[10]

- a) What are the applications of gas turbine?
- b) Discuss briefly the methods employed for improvement of thermal efficiency of open cycle gas turbine plant.

Q.8. Attempt the following questions (Any Two)

[14]

a) A single cylinder air compressor is required to compress 1 Kg of air from 1 bar to 5 bar. The initial temperature is 28°C. Compare the workdone in following cases with  $R=0.287 \text{ kJ/KgK}$

- i) Isothermal Process
- ii) Polytropic Process  $pV^{1.2} = \text{Constant}$

b) A rotary compressor working between 1 bar and 2.5 bar has internal and external diameters of impeller as 300mm and 600mm respectively. The vane angle at inlet and outlet are 30° and 45° respectively. If the air enters the impeller at 15 m/s. Find speeds of impeller in rpm and workdone by compressor per kg of air.

c) The air enters the compressor of an open cycle gas turbine at pressure of 1 bar and temperature of 20° C. The pressure of the air after compression is 4 bar. The isentropic efficiency of compressor and turbine are 80% and 85% respectively. The air fuel ratio used is 90:1. If the flow rate of the air is 3 kg/s, find

- i) The compressor power and turbine power
- ii) Net power developed

Take  $C_p=1 \text{ kJ/KgK}$  and The expansion and compression index = 1.4 of air and gas. Calorific value of fuel = 41800 kJ/kg

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**B.Tech. (Mech.) (Part - IV) (Semester - VIII) (CBCS)**  
**Examination, March - 2023**  
**MECHATRONICS**  
**Sub. Code : 84843**

**Day and Date : Thursday, 15 - 06 - 2023**  
**Time : 10.30 a.m. to 01.00 p.m.**

**Total Marks : 70**

- Instructions :**
- 1) All main questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Assume if necessary Suitable Data & State Them Clearly.

**SECTION-I**

- Q1) a)** Give four definitions of Mechatronics and explain the concept w.r.t. pick and place Manipulator. [5]  
**b)** Explain different types of sensors used in modern Mechatronics system. [5]

**OR**

- Q2) a)** Explain LVDT with neat sketch. [5]  
**b)** What is signal conditioning? Explain Analog to Digital converters (ADC). [5]  
**b)** Explain polling and Interrupt. [5]

- Q3) a)** Explain combinational & sequential logic with suitable example. [7]  
**b)** What are flip-flop circuits? Explain master slave flip flop. [8]

**OR**

Write assembly program for microprocessor 8085 to perform addition of 8 bit numbers and store result. [8]

**SECTION-II**

- Q4) a)** Explain Scan-Update-Scan cycle with respect to PLC. [5]  
**b)** State and explain Symbols used in ladder programming with addressing. [5]

**P.T.O.**



Q5) a) For a PLC based traffic control light application explain. [7]

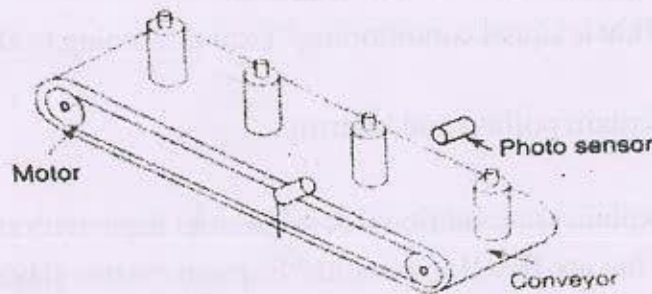
- i) Internal relay
- ii) Counter
- iii) Timer

OR

Draw and explain a physical wiring diagram and Ladder diagram for AND, OR & AND - OR logic. [7]

b) A conveyor motor is required to program using a PLC in a process line based on the number of bottles coming off the conveyor as shown in the figure a photo sensor is used to sense the passage of the bottle. The following tasks are considered: [8]

- i) The start pushbutton can be pressed to start the conveyor motor.
- ii) Bottles move past the photo sensor and the conveyor motor stops. Automatically after a count of 25 bottles.
- iii) The counter is to be reset to zero after 25 counts.
- iv) The conveyor motor can be stopped manually at any time.
- v) The accumulated count of the counter is reset manually by means of the Count reset button.



Q6) a) Explain how SCADA system works. [5]

b) "Industrial automation & control systems prefer to implement Distributed Control System (DCS) instead of centralized" justify the statement. [5]

OR

Explain Distributed Control System (DCS) & centralized control. [5]





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**F.Y. B.Tech. (Mechanical Engineering) (Part - IV) (CBCS)  
(Semester - VII) (Revised) Examination, March - 2023**

**AUTOMOBILE ENGINEERING**

**Sub. Code : 83717**

**Day and Date : Monday, 19 - 06 - 2023**

**Total Marks : 70**

**Time : 02.30 p.m. to 05.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Use of non programmable calculator is allowed.

**Q1) Attempt any two from the following.**

- a) Explain the types of vehicle bodies. [6]
- b) Which are the different types of chassis? What are the materials used for chassis frames? [6]
- c) Explain the different body parts of Automobile with neat sketch. [6]

**Q2) Attempt any two from the following.**

- a) Write different types clutches used in automobiles. Explain centrifugal clutch with neat sketch. [6]
- b) Explain Epicyclic gear train. [6]
- c) Explain working of torque converter with the help of neat sketch list disadvantages. [6]

**Q3) a) What is mean by active suspension? With neat sketch explain any suspension. [5]**

**b) Explain the function, principle of Ackerman Steering mechanism [6]**

**OR**

**c) Explain telescopic shock absorber [6]**

**P.T.O.**

**Q4)** Attempt any two from the following.

- a) Illustrate with neat sketch Air brake system. [6]
- b) What is need of wheel alignment? Which parameters are checked in wheel alignment. [6]
- c) Define tyre size and categories of tyres. What are various tyre specifications? [6]

**Q5)** Attempt any two from the following.

- a) Explain Electronic Controlled Management (ECM) Systems. [6]
- b) Explain the principle and operation of lead - acid battery. [6]
- c) Explain with neat sketch working of starting motor used for engine starting? How Bendix drive work? [6]

- Q6)** a) Explain Air resistance, Rolling Resistance, Gradient Resistance to the Vehicle motion. [5]
- b) How far will a vehicle having a mass of 750 kg and travelling at 37.5 km/hr up a gradient 1 in 10 will travel before stopping when neutral is applied. Its rolling resistance is 155 N? [6]

OR

- c) Write a note on Traction Control System. [6]





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**F.Y. B.Tech. (Mechanical Engineering) (Part - IV) (CBCS)  
(Semester - VIII) (New) Examination, March - 2023**

**INDUSTRIAL ENGINEERING**

**Sub. Code : 84846**

**Day and Date : Wednesday, 21 - 06 - 2023**

**Total Marks : 70**

**Time : 10.30 a.m. to 01.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Assume suitable data if necessary and state it clearly.
  - 3) Figures to the right indicate full marks.
  - 4) Use of non programmable calculator is allowed.

**Q1) Attempt any two from the following.**

- a) What is Industrial Engineering? Explain functions of Industrial Engineering. [6]
- b) What is productivity and importance of productivity? [6]
- c) What are responsibilities of Industrial engineer in Industrial Engineering Department? [6]

**Q2) Attempt any two from the following.**

- a) What is work study explain stepwise procedure of work study. [6]
- b) State different process charts and explain two handed process chart with suitable example. [6]
- c) Explain different symbols use in process charts with suitable example. [6]

- Q3) a) Define Motion study and State principles of motion study. [5]**  
**b) Explain concept of human factor engineering in detail with example. [6]**

**OR**

- c) Explain with the help of detailed block diagram man-machine system. [6]**

**P.T.O.**

**Q4)** Attempt any two from the following.

- Define work measurement and list objectives of work measurement. [6]
- What is performance rating? Why it is required to rate the worker? [6]
- The actual time for various elements in minutes for a study conducted on a machining operation is shown in the following table, [6]

Elements	Cycle Time (In Minutes)				Performance rating in %
	A	B	C	D	
1	1.8	1.9	1.7	1.8	110
2	3.5	3.6	3.7	3.6	100
3	2.5	2.6	2.7	2.8	105
4	6.1	6.2	6.0	6.2	90
5	4.2	4.1	4.3	4.3	115

Calculate the standard time for the given operation.

**Q5)** Attempt any two from the following.

- Explain different factors consider for plant site selection. [6]
- What are external factors affecting on plant selection? [6]
- What are different plant layouts? Explain with example line type plant layout. [6]

- Q6)** a) Define value analysis and explain its steps. [5]
- b) What is implementation process of value analysis an value engineering. [6]

OR

- c) What is value engineering? List various applications of value analysis. [6]

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**F.Y. B.Tech. (Mechanical Engineering) (CBCS)  
(Semester - VII) Examination, March - 2023**

**TOTAL QUALITY MANAGEMENT (Elective - II)**

**Sub. Code : 83724**

**Day and Date : Tuesday, 20 - 06 - 2023**

**Total Marks : 70**

**Time : 02.30 p.m. to 05.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Make suitable assumptions wherever necessary and state them clearly.
  - 4) Use of statistical tables and scientific calculator is permitted.

**Q1) Solve any one.**

- a) How Q.A. differs from Q.C. What are the roles and objectives of Q.A.? [7]
- b) Explain process approach. How it forms basis for ISO quality Management System? [7]
- c) How cost of quality is arrived at? What is the normal ratio of individual category costs to cost of quality? Give examples of prevention expenses. [7]

**Q2) Solve any two.**

- a) What is process capability? On which factors does it depend? [7]
- b) What are the inputs and outputs of product design and development as per APQP? [7]
- c) DPMO in Six Sigma represents opportunities for improvements. How? [7]
- d) Design new vendor selection format for an organization. [7]

**P.T.O.**

**Q3)** Solve any two.

- a) Explain FEMA technique in details with concept and its applications. [7]
- b) Which system is reliable - parallel, series or combined? Why? [7]
- c) Orthogonal arrays are applied in which techniques? What inferences one can draw from them? [7]

**Q4)** Solve any one.

- a) What are the focus areas of theory of Constraints? Prepare a brief write up on Feignbaum's theory of TQC. [7]
- b) Explain with examples role of TEL, JIT and TQC in context of TQM. [7]
- c) How continual improvement can be achieved and sustained in an organization? [7]

**Q5)** Solve any two.

- a) 5S is not merely cleanliness, but it is cultural change. Explain. [7]
- b) Differentiate between Quality circles and CFT on the basis of participation, focus, objectives and benefits to the organization. [7]
- c) What role HR plays in institutionalizing TQM in the Organization? [7]
- d) Management support and commitment is vital in success of TQM implementation. How the leadership can demonstrate this? [7]

**Q6)** Solve any two.

- a) Discuss the impact of quality Award on TQM. How quality award helps an organization? [7]
- b) Discuss eight quality management principles on which ISO : 9001:2008 is based? [7]
- c) State SERVQUAL model and its applications. [7]





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**F.Y. B.Tech. (Mechanical Engineering) (Part - IV) (CBCS)**  
**(Semester - VIII) Examination, March - 2023**  
**PRODUCTION MANAGEMENT**  
**Sub. Code : 84847**

Day and Date : Wednesday, 21 - 06 - 2023

Total Marks : 70

Time : 10.30 a.m. to 01.00 p.m.

- Instructions :
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Assume suitable data whenever necessary.
  - 4) Draw neat sketches if required.

Q1) Attempt any two questions.

- a) Illustrate the role of technology with suitable examples in operations strategy? [6]
- b) With graph, explain the various stages of Product Life Cycle (PLC). What are advantages and limitations of each stage? [6]
- c) Explain Long term capacity strategies. What are effects of under capacity and over capacity? Under what situations these are proffered. [6]

Q2) Attempt any two questions.

- a) Explain Process and product Matrix? [6]
- b) Explain with example relation between volume variety and flow, with respect to process design? [6]
- c) Seven jobs are to be processed on three machines. The processing times are given in the table below. [6]

| Machines  | Jobs (Processing Times) |   |   |    |   |   |    |
|-----------|-------------------------|---|---|----|---|---|----|
|           | A                       | B | C | D  | E | F | G  |
| Machine X | 3                       | 8 | 7 | 4  | 9 | 8 | 7  |
| Machine Y | 4                       | 3 | 2 | 5  | 1 | 4 | 3  |
| Machine Z | 6                       | 7 | 5 | 11 | 5 | 6 | 12 |

Determine the optimal sequence and minimum total elapsed time and idle time of machines.

P.T.O.



Q3) Attempt any two questions.

- Explain Production Planning and Control (PPC)? [6]
- Explain aggregate planning by Transportation Model? [6]
- Data for number of schools and demand for bicycle is given below. Assuming simple linear function exists; estimate the demand for bicycle if number of new schools started is 300 and 500. Use suitable method to estimate the demand of the bicycles. [6]

| X           | Y                  |
|-------------|--------------------|
| New Schools | Demand for Bicycle |
| 400         | 330                |
| 470         | 368                |
| 420         | 360                |
| 394         | 290                |
| 450         | 340                |
| 480         | 338                |

Q4) Attempt any two questions.

- Explain the various activities of SCM. How do you evaluate the performance of Supply chain management? [6]
- Why equipment need replacement? What are the objectives of replacement analysis and what are the costs associated with it? [6]
- How productions Economics influence Manufacturing Scenario? [6]

Q5) Attempt any two questions.

- Distinguish between JIT and Lean Manufacturing? [6]
- Explain TPM and Six big Losses? [6]

- Two bids are offered to install the overhead crane for newly constructed building. The following information is available. [6]

| Bids | Initial Cost (Rs.) | Estimated service life(yrs.) | Annual operation and maintenance costs |
|------|--------------------|------------------------------|----------------------------------------|
| A    | 4,50,000           | 10                           | 30,000                                 |
| B    | 5,40,000           | 10                           | 40,000                                 |

The applicable interest rate is 15%. Determine the NPV of both and suggest the alternative to be chosen

Q6) Attempt any two questions.

- Give the steps in implementation of JIT. How performance of JIT measured? [5]
- Explain Isoquants? [5]
- Electronic equipment contains 1000 resistors. When any resistors fail, it is replaced. The cost of replacing resistors individually is Rs. 8. If all the resistors are replaced at the same time, the cost per resistor is Rs. 2. The percent surviving (Si) at the end of month I is given below: [5]

| Month (i) | 0   | 1  | 2  | 3  | 4  | 5  | 6 |
|-----------|-----|----|----|----|----|----|---|
| S(i)      | 100 | 96 | 89 | 68 | 37 | 13 | 0 |

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**F.Y. B.Tech. (Mechanical Engineering) (Part - IV) (CBCS)**  
**(Semester - VIII) Examination, March - 2023**

**NOISE AND VIBRATION**

**Sub. Code : 84845**

**Day and Date : Monday, 19 - 06 - 2023**

**Total Marks : 70**

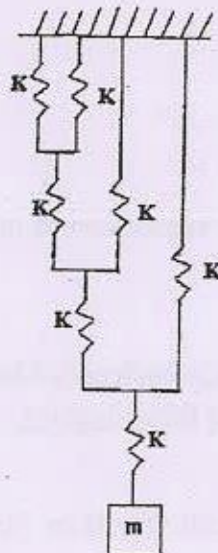
**Time : 10.30 a.m. to 1.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Assume suitable data if necessary.
  - 3) Figures to the right indicate full marks.
  - 4) Use of non-programmable calculator allowed.

- Q1) a)** Explain the different causes of vibrations in machines. Also discuss effects of vibrations. [6]

**OR**

- a) Derive the equation of motion and determine natural frequency of standard spring mass system using Newton's Method or Energy Method. [6]
- b) Find the equivalent stiffness and natural frequency of following system. [6]



**P.T.O.**

Q2) a) Explain the different types of damping. [5]

OR

- a) Explain forced vibrations due to rotating unbalance. [5]  
 b) A machine of mass one tonne is acted upon by an external force of 2450 N at frequency of 1500 rpm. To reduce the effect of vibration, isolator of rubber having static deflection 2 mm under the machine load and an estimated damping ratio (Damping factor) is 0.2. Determine force transmitted to foundation. [7]

Q3) Derive the expression of natural frequencies and mode shapes for the system of two equal masses suspended by strings of equal length as shown in fig.(3) Take,  $l_1 = l_2 = 1$  and  $m_1 = m_2 = m$ . [12]

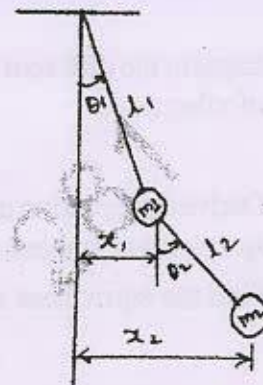


Fig.3

OR

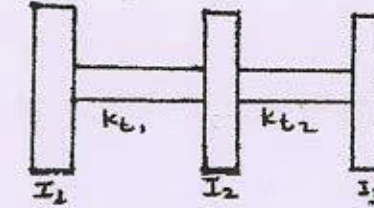
Derive the expression of natural frequencies and mode shapes of Two Rotor System. [12]

Q4) a) Explain Rayleigh's Method used to determine natural frequencies of multi degree free vibrating system. [6]

OR

- a) Write short note on Flexibility and stiffness influence coefficients. [6]

b) Using Holzer Method find natural frequency of system as shown in fig. 4(b) Take  $I_1 = I_2 = I_3 = 1$  and Take  $K_{t1} = K_{t2} = 1$ . [6]



Q5) a) Explain with neat sketch different types of exciters used in FFT analyzer. [6]

OR

- a) Explain the Seismic mass instrument. How it can be used for measurement of Acceleration. [6]  
 b) A vibrometer has a period of free vibration of 2 seconds. It is attached to a machine with vertical harmonic frequency of 1 Hz. If the vibrometer mass has an amplitude of 2.5 mm relative to the vibrometer frame, what is the amplitude of vibration of machine? [6]

Q6) a) Explain sound pressure level and sound intensity level. [5]

OR

- a) Explain octave band analysis and its importance. [5]  
 b) Discuss Subjective and Objective assessment of sound. [5]

OR

- b) Explain the following terms as used in hearing conservation. [5]  
 i) Permanent Threshold shift  
 ii) Daily dose of noise





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**B.Tech. (Mechanical Engineering) (Semester - VII) (CBCS)**  
**Examination, March - 2023**  
**FINITE ELEMENT ANALYSIS**  
**Sub. Code : 83714**

Day and Date : Saturday, 17 - 06 - 2023

Total Marks : 70

Time : 02.30 p.m. to 05.30 p.m.

- Instructions :**
- 1) All questions are compulsory.
  - 2) Use of non-programmable calculator is allowed.
  - 3) Assume suitable data if necessary & state it clearly.
  - 4) Figures to the right indicate full marks.

**Q1)** Attempt any two from the following :

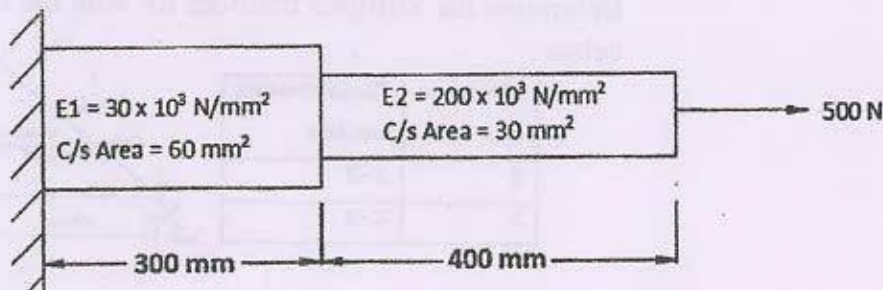
- a) Discuss the general steps of finite element analysis. [6]
- b) Explain the importance of node and element numbering with examples. [6]
- c) Discuss the advantages and disadvantages of finite element method over classical method. [6]

**Q2) a)** List down and briefly explain one dimensional elements used in FEA. [6]

OR

Differentiate between 1D Linear and 1D Quadratic element. [6]

- b) Refer the figure and determine Nodal displacements. [6]

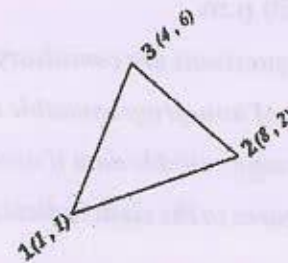


P.T.O.

- Q3) a) Explain Constant Strain Triangle. [6]  
 b) Derive the shape functions for constant strain triangle. [6]

OR

Find the shape functions of CST shown in the figure below. Find the temperature at (2, 2) if the nodal temperatures  $T_1$ ,  $T_2$  and  $T_3$  are  $20^\circ\text{C}$ ,  $100^\circ\text{C}$  and  $150^\circ\text{C}$  respectively. [6]



- Q4) a) Define axisymmetric elements with examples. [6]

OR

Discuss displacement functions for axisymmetric element. [6]

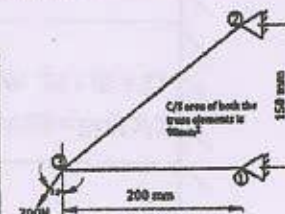
- b) A long cylinder of 100 mm internal diameter and 130 mm external diameter is subjected to hot fluid at  $200^\circ\text{C}$  from inside and ambient conditions on outside. Draw the sketch showing actual problem and also model the problem for a sample length of 10 mm using axisymmetric element with proper boundary conditions. [6]

- Q5) a) Discuss Local and Global Coordinate System with respect to Truss. [6]  
 b) Write down the expression for Stiffness matrix of Truss element and explain the terms involved in it. [6]

OR

Determine the Stiffness matrices for both the elements of truss shown below [6]

Element No.	Constituent nodes
1	1-3
2	2-3



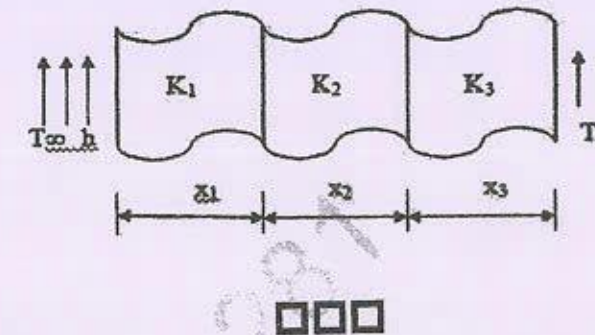
- Q6) a) Explain and discuss one Dimensional heat transfer in thin fins. [4]

OR

Explain general steps of FEM using a simple 1-D element for thermal analysis of heat conduction through a composite wall. [4]

- b) A composite wall, with three layers of different material as shown in fig. The outer temperature is  $T_o = 35^\circ\text{C}$ , convection heat transfer takes place on the inner surface of the wall with  $T_\infty = 500^\circ\text{C}$  and  $h = 40 \text{ W/m}^2\text{ }^\circ\text{C}$ . Calculate temperature distribution in the wall. [6]

$K_1 = 10 \text{ W/m}^\circ\text{C}$ , &  $x_1 = 0.3 \text{ m}$ ,  $K_2 = 20 \text{ W/m}^\circ\text{C}$ , &  $x_2 = 0.15 \text{ m}$ ,  $K_3 = 30 \text{ W/m}^\circ\text{C}$ , &  $x_3 = 0.15 \text{ m}$





MECH

Seat No.	
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QP Code: 4889QP  
Total No. of Pages: 3

### Summer Examination March - 2023

Subject Name: B.Tech. CBCS\_83713\_67502\_83713\_83948 - Mechanical System Design\_16.06.2023\_02.30 PM To 05.00 PM

Subject Code: 83713

Day and Date: - Friday, 16-06-2023  
Time: - 02:30 pm to 05:00 pm

Total Marks: 70

- 
- Q.1. a) Explain Aspects of aesthetic design with suitable examples. (5Marks) [11]  
b) Explain ergonomic considerations in the design of displays and controls. (6Marks)

Or

- b) With suitable example explain the creativity concept in the product design. (6 marks)

- Q.2. a) Derive Clavarino's Equation to determine the thickness of pressure vessels. (05 Marks) [13]

Or

- a) Explain the different types of supports used for horizontal pressure vessels. (05 Marks)

b) The piston rod of a hydraulic cylinder exerts an operating force of 10 kN. The friction due to piston packing and stuffing boxes is equivalent to 10% of the operating force. The pressure in the cylinder is 10 MPa. The cylinder is made of cast iron FG 200 and the factor of safety is 5. Determine the diameter and thickness of the cylinder. (08 Marks)

- Q.3. a) Compare single plate and multi-plate clutches (Dry and wet clutches). (4 marks) [11]

b) A plate clutch consists of one pair of contacting surfaces. The inner and outer diameters of the friction discs are 100 mm and 200 mm respectively. The coefficient of friction is 0.2 and the permissible intensity of pressure is 1 N/mm<sup>2</sup>. Assuming uniform wear theory calculate the power transmitting capacity of the clutch at 750 r.p.m. (07 marks).

Or

b) A flywheel of 100 kg mass and 350 mm radius of gyration is rotating at 500 rpm. It is brought to rest by means of a brake. The mass of the brake drum assembly is 5 kg. The brake drum is made of cast-iron FG260 ( $c = 460 \text{ J/kg}^\circ\text{C}$ ). Assuming that the total heat generated is absorbed by the brake drum only, calculate the temperature rise. (07 marks).



- Q.4. a) Explain the advantages of geometrical progression for selecting the speed steps of a multi speed machine tool gear box. (5marks) [13]

Or

- a) State the difference b/w structural and speed diagram. (5marks)

b) A multi-speed gearbox is to be designed for a headstock of a turret lathe for nine spindle speeds ranging from 60 rpm to 2880 rpm. If the gearbox is driven by 5KW, 1440 rpm electric motor;

(i) Draw the speed ray diagram.

(ii) Draw the gearing diagram.

(iii) Determine the number of teeth on gears in 1st stage. (08 marks)

- Q.5. a). Explain the design considerations of the piston barrel and piston skirt with a neat sketch. (5marks) [11]

- b) The cylinder of a four stroke diesel engine as the following specifications

Brake power = 3.75 kW.

Speed = 1000 rpm.

Indicated Mean Effect Pressure = 0.35 Mpa.

Mechanical Efficiency = 80%

Determine the bore and length of the cylinder liner.

(6marks)

Or

- b) The following data is given for a connecting rod:

Engine speed = 1800 rpm.

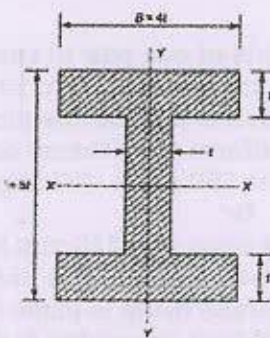
Length of connecting rod = 350 mm.

Length of stroke = 175 mm.

Density of material = 7800 kg/m<sup>3</sup>

Thickness of web or flanges = 8 mm

Assume the cross-section of the connecting rod as shown in the figure below with the area of the cross-section, and calculate whipping stresses in connecting rod. (6marks)



$$(A) = 11t^2, I_{xx} = \left(\frac{419}{12}\right)t^4 \text{ and } y = \left(\frac{5t}{2}\right)$$

- Q.6. a). Explain the objectives of the Material Handling System. (05 marks) [11]

Or

- a) Explain briefly Conveyors and their types. (05 marks)

b). A horizontal flat belt conveyor is used to transport bulk material having a mass density 1000 kg/m<sup>3</sup>. The surcharge factor 'C' for the flat belt is 0.075 while the belt width is 600 mm the belt speed is 0.75 m/sec. Determine the Capacity of the Conveyor. (06 marks)