

Dec 2022

Roll No.

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Total No. of Pages : 02

Total No. of Questions : 08

M.Tech. (ECE) (Sem.-1)
INFORMATION THEORY AND CODING

Subject Code : MTEC-PE2Y-18-3

M.Code : 75179

Date of Examination : 20-01-2023

P.T.U Questions
M.Tech CECET
Sem - 1

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. a) What is the need of coding and encoding? What is a criterion of coding? How are they concerned with entropy, information rate and coding efficiency?
b) Consider a two alphabet source with $p(x_1) = 0.25$ and $p(x_2) = 0.75$. Where $x_1 = 0$, $x_2 = 1$. Find its entropy and coding efficiency. Now, take the third extension of source as S^3 and its alphabets are $\{000, 001, 010, \dots, 111\}$. Find the codes for the new set of symbols using Huffman technique.
2. a) What is sampling theorem. State and prove sampling and reconstruction for band pass sampling.
b) Six analog information signals, each band-limited to 4kHz are required to be time-division multiplexed and transmitted by a TDM system. Calculate
 - i) Nyquist rate
 - ii) Signalling rate
 - iii) Minimum transmission bandwidth of a PAM/TDM channel.
3. a) What do you understand by Digital Modulation and its techniques?
b) Discuss Coherent and non-coherent detection techniques.



4. Write a short note on :

a) PAM signals

b) Data transmission.

5. A source characterized in the frequency domain with a bandwidth of $W = 4000$ Hz is sampled at the Nyquist rate, generating a sequence of values taken from the range $A = \{1/2, 1/4, 1/8, 1/16, 1/16\}$. Calculate the source rate in bits per second.

6. Consider the binary block code C composed of the following four code words :
 $C = \{(00100), (10010), (01001), (11111)\}$

a) What is the number of information bits, K ?

b) What is the number of parity-check bits, C ?

c) What is the minimum distance of this code?

d) What is the maximum weight for which the detection of all error patterns is guaranteed?

e) What is the maximum weight for which the correction of all error patterns is guaranteed?

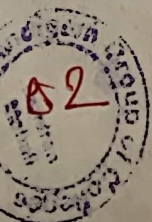
f) Is this code linear? Prove your answer.

7. Explain the difference between PAM, PWM & PPM modulations.

8. a) Find the generator polynomial $g(x)$ for $(7, 4)$ cyclic code, and find code vector for the following data vectors: 1010, 1111.

b) Explain the trellis diagram for Viterbi decoding algorithm with the help of a suitable example.

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Total No. of Pages : 01

Total No. of Questions : 08

M.Tech.(ECE) (Sem.-1)

OPTICAL NETWORKS

Subject Code : MTEC-PE1X-18-2

M.Code : 75175

Date of Examination : 19-01-23

Time : 3 Hrs.

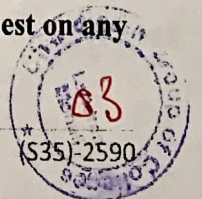
Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. a) Explain the benefits of SONET/SDH over PDH.
b) Why is Optical Network known as digital Wrapper Technology? Briefly explain the capability of OTN.
2. Enlist and explain the applications of Multiprotocol Label Switching in an IP network.
3. What do you mean by OADM? What are the key attributes that must be taken care while choosing a OADM? Explain different types of OADM architectures.
4. What do you mean by optical cross connects? Explain the key functions of OXC.
5. Discuss the functions of network management in detail. What is the need of decentralization in management framework?
6. Discuss various protection techniques used in SONET /SDH.
7. Write a short note on:
 - a) First Passage Traffic Model
 - b) Blocking Traffic Model.
8. a) Give two important features of GPON. Briefly describe.
b) Explain the concept of input and output buffering in brief.

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Total No. of Pages : 02

Total No. of Questions : 08

M.Tech.(ECE) (Sem.-1)

WIRELESS AND MOBILE COMMUNICATION

Subject Code : MTEC-102-18

M.Code : 75173

Date of Examination : 14-01-23

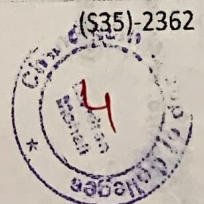
Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

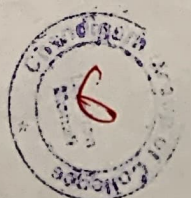
1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. a) What is Cell splitting? What are the advantages of Cell splitting? Distinguish between Permanent splitting and Dynamic splitting.
b) What is adjacent channel interference? Discuss different methods of adjacent channel interference reduction and cell coverage improvisation.
2. a) Explain the frame format of GSM system. How data encryption is performed in GSM system?
b) Discuss the frequency management of GSM system. Explain the call process in GSM system.
3. a) How multiple access techniques used in a cellular communication for resource allocation? Compare CDMA and FDMA in detail.
b) Explain in detail about how a call initiated by a landline subscriber to a mobile subscriber is established with the help of timing diagram.
4. With the help of two-ray ground reflection model, derive the expression of electric field (E) and power received (P_r) at distance "d" from the transmitter in terms of transmitting and receiving antenna gain, height and transmitted power " P_t ".
5. a) Define rms delay spread and excess delay spread of multipath fading channel. How coherence bandwidth depends on these time dispersion parameters?



- b) Distinguish between Flat fading and Frequency selective fading on the basis of different multipath parameters. Explain Rician fading channel model.
6. a) How receiver diversity is helpful in mitigating the effects of multipath fading? Explain equal gain combining technique in detail.
- b) Classify different equalization techniques used in wireless communication system. Explain zero forcing equalization in detail.
7. a) Explain the specification and features of GPRS system.
- b) Explain the forward link and reverse link operation of IS-95 CDMA system.
8. Write a short note on :
- a) CDMA 2000
- b) LTE and VoLTE
- c) Okumura-Hata channel model.

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Total No. of Questions: 08

Total No. of Pages: 01

M.Tech. (ECE) (Sem. - 2)
ANTENNAS AND RADIATING SYSTEMS

Subject Code: MTEC-103-18

M Code: 76259

Date of Examination: 13-12-2022

P.T.U Question
M.Tech (ECE)
Sem - 2

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

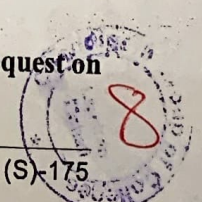
1. Describe radiation pattern, radiation power density, radiation intensity, HPBW, FNBW, efficiency of an antenna.
2. Explain bandwidth, polarization, types of polarization, input impedance, antenna vector effective length in detail.
3. a) Explain the types of antenna and their possible application areas.
b) Derive Friis transmission equation.
4. Derive the expression of electric field intensity, magnetic field intensity, power radiated by an infinitesimal dipole antenna. Also, determine the radiation resistance of this antenna.
5. Normalized array factor of N-element array is given as -

$$AF_n = \frac{1}{N} \left[\frac{\sin\left(\frac{N\psi}{2}\right)}{\sin\left(\frac{\psi}{2}\right)} \right]; \quad \psi = kd \cos \theta + \beta$$

Each element of the array is excited by identical amplitude but β progressive phase shift. The elements are spaced d distance from their neighboring elements. Derive the expression for directions of the nulls of the array (θ_n), directions of maximum of the array (θ_m), directions of half-power of the array (θ_h), HPBW and FNBW.

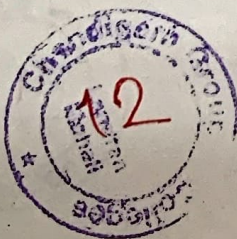
6. a) Explain the working of circular loop antenna with non-uniform current distribution.
b) Explain the working of conical horn antenna.
7. a) Explain feeding mechanism and method of analysis used in microstrip antenna.
b) Explain circular patch microstrip antenna in detail.
8. Explain the working of plane reflector and Cassegrain reflector antenna with the help of suitable diagram.

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6. A transmitter sends a messages containing six letters a_1, a_2, a_3, a_4, a_5 and a_6 with probability 0.1, 0.4, 0.06, 0.1, 0.04, 0.3 respectively. If the message is compressed with Huffman coding, determine encoding bits for each of the letters. Also determine compression ratio.
7. a) Write short notes on LANDSAT and SPOT.
b) An image is 2400 pixels wide and 2400 pixels high. The image was scanned at 300dpi. What is the physical size of the image?
8. a) Discuss the role of remote sensing to improve land fertility and to curb the deforestation.
b) Write down the role of remote sensing to control the environment pollution and in disaster management.

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Total No. of Questions : 08

Total No. of Pages : 01

M.Tech. (CSE) (Sem.-1)

MACHINE LEARNING

Subject Code : MTCS-105-18

M.Code : 75155

Date of Examination : 17-01-23

Time : 3 Hrs.

Max. Marks : 60

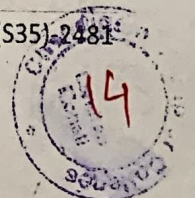
P.T.U Question
M.Tech CSE
Sem-1

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. Differentiate between Supervised and Unsupervised Learning.
2. Write a detailed note on multi-class/structured outputs and ranking in binary classification.
3. Define Clustering. How k-means performs clustering?
4. Define PCA. How it helps in dimensionality reduction?
5. Explain the procedure to evaluate machine learning algorithms.
6. Discuss Modeling sequence and Time series data in details.
7. Define Reinforcement Learning. Discuss also about Bayesian learning.
8. Write a note on recent trends in various models for IOT applications.

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Total No. of Pages : 02

Total No. of Questions : 08

M.Tech.(Computer Science & Engineering) (Sem.-1)

DATA SCIENCE

Subject Code : MTCS-108-18

M.Code : 75158

Date of Examination : 19-01-2023

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

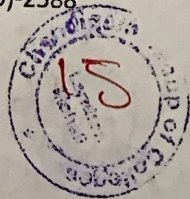
1. a) What is the curse of dimensionality?
b) How do you decide whether your linear regression model fits the data?
2. What is the difference between squared error and absolute error? In a population of tiny birds, the diameter of the egg and the weight of the hatchling (the baby bird that hatches from the egg) follows the regression model. The summary statistics in the sample are: correlation = 0.75

	mean	SD
egg diameter (mm)	23	0.5
bird weight (gm)	6	0.4

Find the regression estimate of the weight of a bird that hatches from an egg of diameter 24 mm.

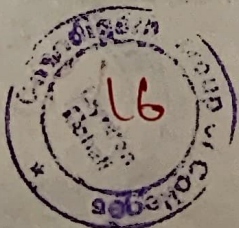
3. In a population, 85% of the people are in Class A and the remaining 15% are in Class B. For people in Class A, a classifier has an accuracy of 90% (that is, among Class A people, 90% are classified as Class A and 10% as Class B). For people in Class B, the accuracy of the classifier is 98%. One person is picked at random from the population.

What is the chance that the person is classified correctly?



4. What technique is used to predict categorical responses? What is logistic regression? State an example when you have used logistic regression recently.
5. Why data cleaning plays a vital role in analysis? Differentiate between univariate, bivariate and multivariate analysis.
6. What are the different methods of collecting large amount of Data from Social Media? What are the most popular APIs used for Data Collection? What are the different rate limitations on these APIs? How is data collected from multiple sources handled?
7. What are categorical variables? A test has a true positive rate of 100% and false positive rate of 5%, There is a population with a 1/1000 rate of having the condition the test identifies. Considering a positive test, what is the probability of having that condition?
8. In a large random sample of U.S. households, the median annual income is \$54,000. This original sample is bootstrapped 5,000 times and the sample median is recorded for each of the bootstrap samples. The middle 95% interval of these values is (\$53,000, \$55,000).
 - a) True or false (explain your answer): The interval (\$53,000, \$55,000) is an approximate -bootstrap 95% confidence interval for the median income of all the households in the sample.
 - b) Pick the option that you think best completes the sentence, and explain your choice. The percent of all U.S. households with annual incomes in the range (\$53,000, \$55,000)
 - I. Is about 95%.
 - II. Is about 50%.
 - III. cannot be approximated based on the information given.

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Total No. of Pages : 01

Total No. of Questions : 08

M.Tech. (CSE) (Sem.-1)
ADVANCED DATA STRUCTURES

Subject Code : MTCS-102-18

M.Code : 75154

Date of Examination: 14-01-2023

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. a) Define Dictionary and Dictionary with duplicates. List the operation performed on dictionary.
b) Explain in detail how symbol tables are implemented? Mention the applications of symbol tables too.
2. Write short notes on :
 - a) Rehashing
 - b) Extendible hashing.
3. What are probabilistic skip lists? Explain search and update operations on skip lists.
4. Explain deletion procedure in AVL tree with an example.
5. a) Draw the flowchart for Knuth-Morris-Pratt algorithm,
b) Explain the main features of Boyer-Moore algorithm.
6. What is range searching in computational geometry? Explain two dimensional range searching.
7. Discuss about :
 - a) Lazy binomial queues.
 - b) Recent trends in hashing
8. Create a 2-3 tree from the following list of data items :
5, 6, 8, 21, 12, 30, 34, 27, 23, 4, 33, 7, 24, 9, 10, 11, 13, 38

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Total No. of Pages : 01

Total No. of Questions : 08

M.Tech. (CSE) (Sem.-1)
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Subject Code : MTCS-101-18

M.Code : 75153

Date of Examination: 12-01-2023

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. What is sampling distribution? State Central limit theorem. Discuss properties of central limit theorem with the help of suitable example.
2. What is Random Sampling? Discuss different advantages of random sampling. Explain the different types of Random Sampling techniques.
3. Explain the problem of overfitting in the regression analysis with the help of graphical representation. How we can detect and avoid overfitting models?
4. Define isomorphism in graph theory. Compare Hamilton Path and Euler path using the suitable example. Discuss few properties of each path.
5. Discuss different applications of Machine learning. How machine learning technology will impact the society in present and coming times.
6. "The concept of soft computing is based on learning from experimental data". Justify this statement. Discuss elements of soft computing.
7. Write a short note on
 - a) Correlation and Regression
 - b) Probabilistic inequalities
 - c) Method of Maximum likelihood
8. What is Markovchain? How to specify a Markovchain? Mention the Markov property.

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Total No. of Pages: 01

Total No. of Questions: 08

M.Tech. (CSE) (Sem. - 2)

COMPUTER VISION

Subject Code: MTCS-208-18

M Code: 76059

Date of Examination : 24-12-2022

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. What is image analysis? How it is performed? How binary images are analysed?
2. Explain with the help of example, edge detection technique.
3. What is morphological filtering? Explain the concept of Fourier transformation.
4. a) Describe feature extraction technique with example.
b) What are the various features of an image?
5. Differentiate between supervised, un-supervised and semi-supervised classification.
6. How dimensional reduction is performed using PCA, LDA and ICA methods?
7. How image patterns are analyzed using mixture of Gaussians?
8. Write a detailed note on biometrics and activity recognition.

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*P.T.U Questions
M.Tech CSE
Sem - 2-13*

Roll No.

Total No. of Pages : 02

Total No. of Questions : 08

M.Tech. (CSE) (2018 Batch) (Sem.-3)

OPERATIONS RESEARCH

Subject Code : MTOE-303-18

M.Code : 76514

Date of Examination : 16-12-22

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. Use Simplex Method to solve the following LP problem:

$$\text{Maximize } Z = 5X_1 + 3X_2$$

$$\text{Subject to: } X_1 + X_2 \leq 6,$$

$$2X_1 + 3X_2 \leq 12$$

$$X_1 \leq 3,$$

$$X_2 \leq 3 \text{ and } X_1, X_2, \geq 0$$

2. Explain the different types of models used in Operations Research. Briefly explain the general methods of solving these Operations Research models.
3. a) Define dynamic programming. How is it different from linear programming?
b) Explain deterministic and probabilistic dynamic programming.
4. a) What do you understand by the term duality in LP problem? State and illustrate the various rules of converting primal into dual.
b) Explain economic interpretation of dual variables.



5. Six jobs have to be processed on machines M_1 , M_2 and M_3 in order M_1 , M_2 and M_3 . Time taken (in minutes) by each job on these machines is given below. Determine the sequence so as to minimize the processing time.

Job	M_1	M_2	M_3
1	12	7	3
2	8	10	4
3	7	9	2
4	11	6	5
5	10	10	3
6	5	5	4

6. Solve the following game by using the rule of dominance:

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

7. a) What is critical path analysis? Describe with illustration its utility in project planning and control.
 b) Explain the role of sensitivity analysis in Linear Programming.
8. a) What are the types of analysis under parametric programming? Explain these in brief.
 b) Explain Kuhn-Tucker conditions with the help of a suitable example.

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Total No. of Pages : 02

Total No. of Questions : 08

M.Tech (ME) (Sem.-1)

ADVANCED ENGINEERING MATERIALS

Subject Code : MTME-101

M.Code : 74715

Date of Examination: 14-01-2023

Time : 3 Hrs.

Max. Marks : 100

P.T.U Questions
M.Tech (ME)
Sem-1

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.

1. a) Define the difference between elastic and plastic deformation in terms of the effect on the crystal lattice structure.
b) How do grain boundaries contribute to the strain hardening phenomenon in metals?
2. a) "Composite materials have gained wide acceptance in the Automobile industry."
Comment on this statement and give some real life examples.
b) What are dispersion-strengthened composites? Name the materials that are generally used in the fabrication of these composites.
3. a) Define shape memory effect. Cite the suitable examples of shape memory alloys and their applications.
b) Why Nickel based super-alloys are preferred for steam turbine casing of jet engines?
4. a) Which reinforcing fibers are generally used in making composite materials? What is the range in length and diameter of the reinforcing fibers?
b) For a polymer-matrix fiber-reinforced composite, list three functions of the matrix phase and compare the desired mechanical properties of the matrix and fiber phases.
5. a) Explain why the mechanical properties of ceramics are generally better than those of metals? What are the limitations of ceramics as engineering materials?
b) Describe the structure of glass and give its important properties.

6. What are smart materials? Comment on the scope of these materials in bio-medical applications. Give some specific examples.
7. a) Define Shape Memory Effect (SME). How Shape memory alloys are useful in biomedical applications?
b) Define Biocompatibility. Discuss the properties and application of Mg alloys as a Biomaterial.
8. Write in brief on following :
 - a) Functional Materials
 - b) Bio-ceramic coatings
 - c) High Strength high heat resisting materials
 - d) Laminated composites.

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M.Tech (ME) (Sem.-1)

FINITE ELEMENT ANALYSIS

Subject Code : MTME-102

M.Code : 74716

Date of Examination : 16-01-2023

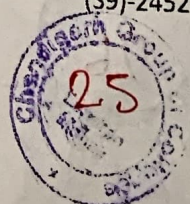
Time : 3 Hrs.

Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions in all.
2. Each question carries TWENTY marks.

1.
 - a) What do you understand by isoparametric mapping? What are the convergence criteria for the isoparametric element?
 - b) Discuss any one technique used for solving three-dimensional integration problems, by taking a suitable example.
2.
 - a) What is a global stiffness matrix? How will you assemble a global stiffness matrix for a single truss element?
 - b) Using the first theorem of Castigliano, develop a flexure element for properly exhibiting transverse bending effects.
3.
 - a) What is a shape function? What are the different types of shape functions used in Finite element analysis?
 - b) Differentiate between a truss element and a flexure element. Discuss the elementary beam theory used for developing flexure elements.
4. For four-noded isoparametric quadrilateral Element, derive shape functions in natural coordinates and obtain Jacobian matrix.
5. Analyze a simply supported beam subjected to a uniformly distributed load throughout using Rayleigh Ritz method. Adopt one-parameter trigonometric function. Evaluate the maximum deflection and bending moment and compare with the exact solution.



6. Develop a one-dimensional finite element model of heat transfer including both conduction and convection for a solid cylindrical body surrounded by a fluid medium. Assume boundary conditions.
7. Derive the governing equations for a general three dimensional flow. How will you modify this equation for steady flow of an incompressible fluid?
8. Write short notes on :
 - a) Difference between boundary value and initial value problems.
 - b) Pre and Post processing in FEA.
 - c) Weighted residual's method.
 - d) Stream functions.

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Dec 2022

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M.Tech (ME) (Sem.-1)
OPERATIONS MANAGEMENT
Subject Code : MTME-104
M.Code : 74718
Date of Examination : 20-01-2023

Time : 3 Hrs.

Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

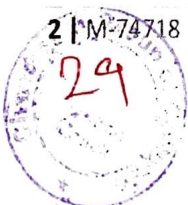
1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.

1. (a) What do you mean by Operations Management? Define characteristics of Production/Operations Management.
(b) Discuss in brief, the different production systems giving their salient characteristics.
2. (a) Explain the technological considerations in product and process design.
(b) Discuss in brief Macro and Micro process design.
3. (a) What are various types of forecasting techniques? Discuss their relative advantages and disadvantages in logistics and supply chain prospective.
(b) Explain qualitative techniques of forecasting & give their advantages and limitations.
4. (a) How do planning and scheduling help in optimizing production?
(b) Define aggregate planning. Explain different approaches and strategies used in aggregate planning.
5. (a) Define material requirement planning. Discuss in detail, the steps involved and benefits of MRP.
(b) What do you mean by MRP II? What is difference between the MRP and MRP II? What are the benefits of MRP II System application?
6. (a) Explain the steps involved in job shop control.
(b) Explain in detail ERP and various elements of ERP giving an example.

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7. (a) *"Location and layout of production facility are important decisions from the point of view of finance and accounting, human resources, MIS, operation and marketing."*
Discuss.
- (b) What are the objectives of good layout? Distinguish between product layout and process layout giving their advantages and applications.
8. Write short note on any two of the following :
- (a) JIT & JIT-II
- (b) Softwares used in demand forecasting
- (c) Principles and types of material flow
- (d) Scheduling and management of multi-stage manufacturing systems.

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Total No. of Pages : 02

Total No. of Questions : 08

M.Tech. (ME) (Sem.-1)
ADVANCED THERMODYNAMICS

Subject Code : MTME-105

M.Code : 74719

Date of Examination : 23-01-2023

Time : 3 Hrs.

Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions in all, out of EIGHT questions.
2. Each question carry TWENTY marks.

1. Briefly explain the following :
 - a) Vander Waal's equation
 - b) Sensible Heating
 - c) Relative Humidity
 - d) Refrigeration effect
2. a) Heat (QH) is rejected from the condenser to the ambient in a refrigeration cycle for which the temperature TH (ambience) is 10°C below the condenser temperature. Similarly heat is added to the evaporator from a cold space at a temperature TL. The evaporator coil is at a temperature that is 10°C below TL. Is it possible to use the heat transfer QH to reduce the work input to the compressor? Comment.
b) Obtain an expression for dh and du for a liquid in terms of c_p , β_P , β_T , c_v , dT and dP . Simplify the relations for an incompressible liquid.
3. a) A rubber product contracts upon heating in the atmosphere. Does the entropy increase or decrease if the product is isothermally compressed? Discuss with proof.
b) For a steady state process involving an open system $dm_{cv}/dt = 0$, i.e., mcv is constant. Is this always true for a closed system? Comment with suitable examples (if any).
4. a) The Joule Thomson effect can be depicted through a porous plug experiment that illustrates that the enthalpy remains constant during a throttling process. In the experiment a cylinder is divided into two adiabatic variable volume chambers A and B by a rigid porous material placed between them. The chamber pressures are maintained constant by adjusting the volume. Freon vapor with an initial volume $V_{A,1}$, pressure $P_{A,1}$ and energy $U_{A,1}$ is present in chamber A. The vapors penetrate through the porous wall to reach chamber B. The final volume of chamber A is zero.



Determine the work done by the gas in chamber B, and the work done on chamber A. Apply the First Law for the combined system A and B and show that the enthalpy in the combined system is constant.

- b) Show that generally real gases deliver a smaller amount of work as compared to an ideal gas during isothermal expansion for a (a) closed system from volume v_1 to v_2 , and (b) an open system from pressure P_1 to P_2 .
5. Show that the Joule-Thomson coefficient, μ is given by $\mu = 1 / c_p (T (\partial v / \partial T)_p - v)$. Hence or otherwise show that the inversion temperature (T_1) is $T_1 = (\partial T / \partial v)_p v$.
6. a) Obtain an expression for the enthalpy change, dh in a Clausius I fluid that follows the relation $P = RT/(v-b)$, and show that c_p is a function of T alone.
b) Obtain a relation for ds for an ideal gas. Using the criterion for an exact differential show that for this gas c_v is only a function of temperature.
7. Write a short note on following:
a) Photovoltaic cells b) Magneto Hydrodynamic Generators.
8. a) Distinguish between an ideal and a perfect gas and show that in both cases the specific entropy, s , is given by

$$s = s_0 + \int_{T_0}^T \frac{dh}{T} - R \ln \left(\frac{p}{p_0} \right)$$

- b) If a fluid consisting of a single component is contained in m mo containers at different temperatures, show that the difference in pressure between the two containers is given by

$$\frac{dp}{dT} = \frac{h - u^*}{vT}$$

where h - specific enthalpy of the fluid at temperature T .

u^* = the energy transported when there is no heat flow through thermal conduction.

v - specific volume.

T - temperature.

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Total No. of Pages : 02

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M.Tech. (ME) (Sem.-2)
COMPUTATIONAL FLUID DYNAMIC

Subject Code : MTME-204

M.Code : 74980

Date of Examination : 20-12-22

Time : 3 Hrs.

Max. Marks : 100

P.T.U Questions
M.Tech CME
Sem, 213

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions in all.
2. Each question carries TWENTY marks.

1. a) What is CFD? Explain CFD methodology by giving steps in a CFD simulation?
b) Explain the impact of CFD in today's engineering activity by giving minimum four practical examples.
2. Consider first order wave equation :

$$\frac{\partial u}{\partial t} + C \frac{\partial u}{\partial x} = 0$$

Present above equation in discretized form and obtain condition for stability of its numerical solution.

3. a) Identify and classify the following PDE's into elliptic, parabolic, hyperbolic equations. Give one practical example of each type.

i) $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$

ii) $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$

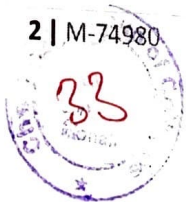
iii) $\frac{\partial u}{\partial t} + c \frac{\partial T}{\partial x} = 0$

- b) List any two types of errors encountered in numerical methods. Indicate how the errors occur.
4. Develop the solution algorithm for one dimensional transient heat conduction problem based on:
a) Implicit scheme, b) Explicit scheme.

5. a) Write down step by step procedure for SIMPLER algorithm.
b) Discuss stream function vorticity formulation. What is its advantage?
6. a) Develop solution methodology for 2D, unsteady convection-diffusion equation giving practical example.
b) Explain Dirichlet, Neumann and Mixed type boundary conditions.
7. a) Discuss vortex panel method with example.
b) Discuss cell centred formulation in finite volume technique.
8. Enlist the different turbulent modeling schemes. Discuss RANS model in details.

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Total No. of Pages: 02

Total No. of Questions: 08

M.Tech. (ME) (Sem. – 3)
AUTOMATION AND ROBOTICS

Subject Code: MTME-206

M Code: 74982

Date of Examination: 16-12-2022

Time: 3 Hrs.

Max. Marks: 100

INSTRUCTIONS TO CANDIDATES:

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.

1. a) Present graphically and explain the various types of production automation as a function of production volume and product variety.
b) Why the industrial automation is necessary in today's production scenario. Elaborate the various factors that oppose industrial automation.
2. a) What are the various cost associated with a manufacturing unit. Discuss and elaborate in detail.
b) What is buffer storage? Why it is required in automated lines?
3. Discuss the following types of work-part transport systems used in industry
 - a) Continuous transfer
 - b) Intermittent and synchronous transfer
 - c) Asynchronous or power and feed transfer.
4. An eight station rotary machine operates with an idle cycle time of 20 s. The frequency of line stop occurrence is 0.06 stop/cycle on average. When a stop occurs, it takes an average of 3 min to make repairs. Determine the followings:
 - a) Average production time T_p
 - b) Average production rate R_p



- c) Line efficiency E
- d) Proportion of downtime D
5. a) What is the rotation matrix for a rotation of 45° about the OZ axis, followed by the rotation of 30° about the OX axis, followed by the rotation of 90° about the OY axis?
- b) Sketch the 'Geneva' and 'Ratchet & Paul' Mechanism.
6. a) Graphically represent the followings:
- i) One dimensional representation of control and special resolution
 - ii) One dimensional representation of accuracy and resolution
 - iii) Unidirectional repeatability
 - iv) Bidirectional repeatability
- b) Sketch the work envelop of the various robots configurations.
7. a) Write the ASIMOV'S laws of Robots and sketch and configuration of a robotic arm.
- b) Design a composite rotation matrix when the joint is rotated about an arbitrary axis.
8. Write a short note on the following:
- a) Group technology
 - b) Automated guided vehicles

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M.Tech. (Mechanical Engineering) (Sem.-3)
MAINTENANCE AND RELIABILITY ENGINEERING

Subject Code : MTME-211

M.Code : 74987

Date of Examination : 23-12-22

Time : 3 Hrs.

Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT question.
2. Each question carry TWENTY marks.

1. a) What is the objective of Maintenance Engineering? (10)
b) How do you classify various types of Maintenance? (10)
2. a) How do you differentiate between Preventive and Proactive Maintenance? (10)
b) What are the functions covered in Maintenance planning? (10)
3. a) What is objective of Reliability centred maintenance? How is it implemented? (10)
b) Why do you need to operate/prepare equipment history? How does it help in failure analysis? (10)
4. a) What are the various Hazard factors in safe plant operation? (10)
b) How the hazard can be minimized by effective Housekeeping? Explain. (10)
5. a) What are the different Reliability Structure and design configurations? (10)
b) What is the objective of Root Cause Analysis? How it is implemented? (10)
6. Develop a fault Tree Analysis diagram for four:
a) Wheeler Hydraulic Brake not operating. (10)
b) What is a constant failure rate model? Which distribution uses this parameter? What is the applicability of such distributions? (10)



7. a) What is a bath tub curve? Distinguish the various phases in them. (10)
b) How is conditional Reliability different from instant Reliability? Give its advantage for equipment useful size. (10)
8. Write short notes on the following : (20)
a) Design for Maintainability
b) FMECA Method Application.

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M.Tech. (Mechanical Engineering) (Sem.-3)

MECHATRONICS

Subject Code : MTME-216

M.Code : 74992

Date of Examination : 24-12-22

Time : 3 Hrs.

Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT question.
2. Each question carry TWENTY marks.

1. What is control system? What are the different types of control systems?
2. What is Operational Amplifier? Discuss various methods of using the operational amplifiers.
3. How sensors are selected for the specific use? Discuss various Temperature sensors.
4. What are the various types of valves used in pneumatic systems?
5. Explain the working and classification of DC motor.
6. Explain the working of automatic Camera.
7. Explain PLC diagram in detail.
8. Give the different between Microprocessors and Microcontrollers.

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M.Tech. (Mechanical Engineering) (Sem.-3)
INSTRUMENTATION AND CONTROL ENGINEERING

Subject Code : MTME-222

M.Code : 74998

Date of Examination : 02-01-23

Time : 3 Hrs.

Max. Marks : 100

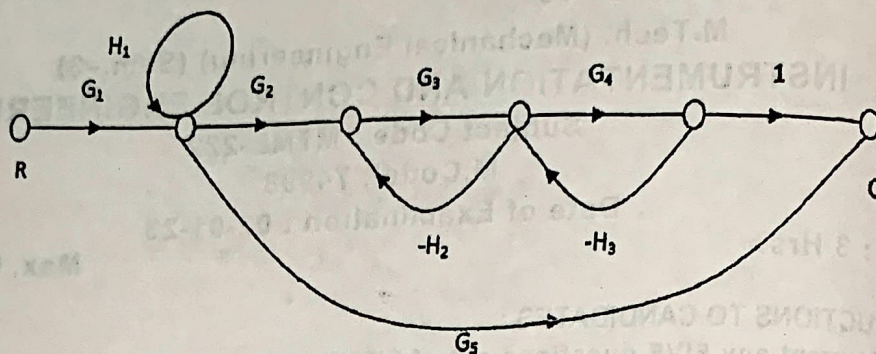
INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT question.
2. Each question carry TWENTY marks.

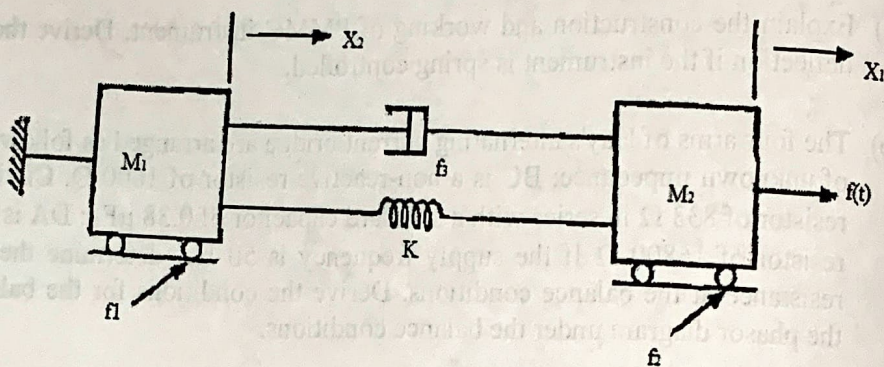
1. a) Explain the construction and working of PMMC instrument. Derive the equation for deflection if the instrument is spring controlled.
b) The four arms of Hay's alternating current bridge are arranged as follows: AB is a coil of unknown impedance: BC is a non-reactive resistor of 1000 Ω : CD is non-reactive resistor of 833 Ω in series with a standard capacitor of 0.38 μF . : DA is a non-reactive resistor of 16800 Ω If the supply frequency is 50 Hz, determine the inductance & resistance at the balance conditions. Derive the conditions for the balance and draw the phasor diagram under the balance conditions.
2. Explain :
 - i) Fixed and variable AF oscillators
 - ii) Square and pulse generator
3. Differentiate between the following by considering suitable examples
 - i) Open loop and closed loop systems
 - ii) Continuous and sampled data control systems
 - iii) Linear and non-linear systems
 - iv) Time variant and time invariant systems



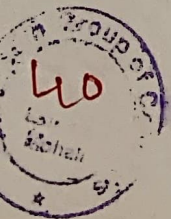
4. a) Determine the transfer function of the Signal Flow Graph shown below :



- b) On the basis of force current analogy write the equations and find $F(s)/X_1(s)$ & $F(s)/X_2(s)$ for the system given below



5. The open-loop transfer function of a unity feedback system is $(s) = \frac{4}{s(s+1)}$. Determine the nature response of the closed loop system for a unit step input. Also determine the rise time, peak time, peak overshoot and settling time.
6. Explain
- Magnetic amplifier
 - AC and DC techno-generators
7. a) Using Nyquist Criterion investigate the closed loop stability of the system whose open loop transfer function is given by $G(s) H(s) = \frac{K}{s(sT_1 + i)(sT_2 + 1)}$



b) Construct the Bode plot of the system whose open loop transfer function is given by

$$G(s)H(s) = \frac{4}{s(1+0.5s)(1+0.08s)}$$

8. Discuss

i) Anderson's and Schering bridge

ii) Routh -Hurwitz criterion with examples of each case

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