

Note: This question contains TWO pages If any data is missing, then assume it and mention it at the starting point of your answer. All the best!!!

Part A: Answer All

(5 × 1 = 5 Marks)

- Q1. (a) What is meant by finite element?
 (b) What is the basic of finite element method?
 (c) State the properties of a stiffness matrix.
 (d) What are the methods are generally associated with the finite element analysis?
 (e) What is natural co-ordinate?

Part B: Answer Any Six

(6 × 4 = 24 Marks)

- Q2. (a) What is meant by DOF? Distinguish between potential energy function and potential energy functional?
 (b) What are the different types of element? Draw their shape. How do you calculate the size of the global stiffness matrix?
 (c) What is Aspect ratio? State the various phases of finite element method.
 (d) What do you mean by weak formulation? State its advantages.
 (e) Name any four FEA softwares. What is discretization in FEM?
 (f) Define shape function. What are the characteristic of shape function?
 (g) Distinguish Natural & Essential boundary conditions?

Part C: Answer Any Three

(3 × 7 = 21 Marks)

- Q3. (a) Consider the bar shown in Fig. 1. An axial load $P_3 = 1000$ N is applied as shown. Find out Displacement, stress & strain. Take $A_1 = 200$ mm², $A_2 = 100$ mm², $E_1 = 2 \times 10^6$ N/mm² and $E_2 = 2E_1$, $l_1 = l_2 = 100$ mm.

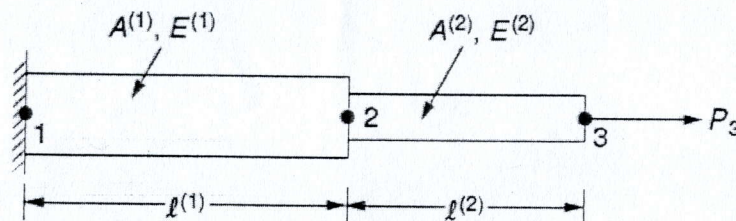


Fig. 1

- (b) Using Rayleigh-Ritz method, find out deflection at the center of simply supported beam, as shown in Fig. 2.

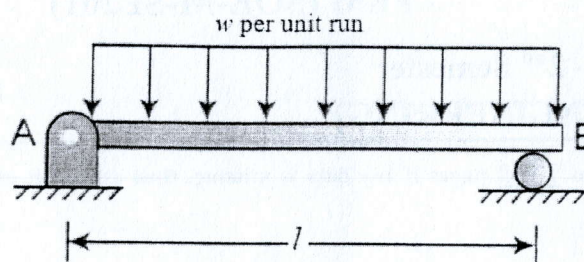


Fig. 2

- (c) The following differential equation is available for a physical phenomenon.

$$AE = \frac{d^2u}{dx^2} + ax = 0,$$

The boundary conditions are $u(0) = 0$, $AE = \frac{du}{dx} \Big|_{x=L} = 0$,

By using Galerkin's technique, find the solution of the above differential.

- (d) What is constitutive relationship? Express the constitutive relations for a linear elastic isotropic material including initial stress and strain.
- (e) For the beam and loading shown in Fig. 3, calculate the nodal displacements. Take $[E] = 210$ GPa, and $I = 6 \times 10^{-6} \text{ m}^4$.

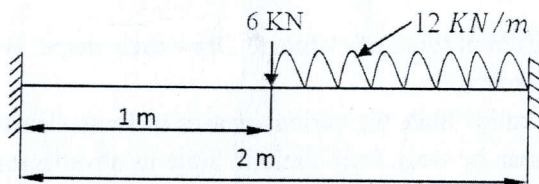


Fig. 3

Theory of Plates and Shells [SOE-M-SE202]

COURSE - II Semester

TIME: 02 Hrs

BRANCH - CIVIL

MAX MARKS: 50

Q1 All Questions are compulsory.

- | | |
|---|---|
| a) Write down the Equilibrium equations only? | 2 |
| b) Write down the constitutive equations? | 2 |
| c) What is stress and strain? | 2 |
| d) Write down the fundamental assumptions of the linear, elastic, small-deflection theory of bending for thin plates? | 2 |
| e) What do you mean by isotropic and homogeneous? | 2 |

Q2 Answer any Four questions.

- | | |
|--|---|
| a) Write down about Kirchhoff's plate theory? | 4 |
| b) Brief about principle of minimum potential energy? | 4 |
| c) Write down kinematic equations? | 4 |
| d) Write down three independent conditions of equilibrium? | 4 |
| e) Write down about Compatibility equations? | 4 |

Q3 Answer any three questions.

- | | |
|---|---|
| a) Write down about governing equation for deflection of plates in cartesian coordinates? | 8 |
| b) Write down about rectangular boundary conditions? | 8 |
| c) Write down about the principle of conservation of energy and the principle of virtual? | 8 |
| d) Write down stresses, stress resultants, and stress couples? | 8 |

*******Best Luck*******

Advanced Design of Foundation [SOE-M-SE204(1)]

M. Tech. - 2nd Sem. (Civil)

TIME : 02 Hrs

MAX MARKS : 50

Q1. Answer all the questions.

[5 x 1=5]

- Write difference between foundation and footing.
- What is net safe bearing capacity?
- Define soil exploration.
- Write two basic criteria for design of the foundation.
- What is boring?

Q2. Answer any six questions.

[6 x 4=24]

- Write the assumptions of Terzaghi's bearing capacity theory.
- Differentiate general shear failure and local shear failure.
- Describe Standard Penetration Test(SPT).
- Determine the allowable gross load and the net allowable load for a square footing of 2m side and with a depth of a foundation of 1.0m. Use Terzaghi's theory and assume local shear failure. Take a factor of safety of 3.0. The soil at the site has $\gamma=18\text{kN/m}^3$, $C'=15\text{kN/m}^2$ and $\Phi=25^\circ$. ($N_c=14.8$, $N_q=5.6$, $N_\gamma=3.2$).
- A footing 2m square is laid at a depth of 1.3m below the ground surface. Determine the net ultimate bearing capacity using IS code method. Take $\gamma=20\text{kN/m}^3$, $\Phi'=30^\circ$ and $C'=0$. ($N_c=30.14$, $N_q=18.4$, $N_\gamma=22.4$).
- Distinguish static cone penetration test and dynamic cone penetration test.
- Write the process involve in wash boring.

Q3. Answer any three questions.

[7 x 3=21]

- Discuss effect of water table on the bearing capacity of the soil.
- What are different types of settlements which can occur in a foundation? How are these estimated?
- Describe plate load test. What are its limitations and use?
- Write the expression for
 - Ultimate bearing capacity of strip footing.
 - Ultimate bearing capacity of square footing.
 - Ultimate bearing capacity of circular footing.
 - Ultimate bearing capacity of rectangular footing.
 - Ultimate bearing capacity at purely cohesion less soil.
- What are different types of shallow foundations? Explain with the help of sketches.

Best of Luck

Note:

Q1 All Questions are compulsory [1 marks x 5]

- a) What is a Database?
- b) What are the two major Database Models were in existence in first-generation.
- c) What is ACID properties in a Database?
- d) Write any three Document Databases.
- e) What is YARN refer to in context to Hadoop.

Q2 Answer any six questions [4 marks x 6]

- a) What are the problems with First database revolution?
- b) Describe how Hadoop is powerful.
- c) What are the two complementary significant shifts in the role of data within computer science and society with Big Data Revolution?
- d) Write the drawbacks of a sharding strategy.
- e) Write the importance of document database.
- f) Describe about XML supported ecosystem.
- g) What are the requirements for Amazon's Dynamo.

Q3 Answer any three questions [7 marks x 3]

- a) Describe the major software layers for google platform with a neat diagram.
- b) What is MapReduce, Describe MapReduce with the help of an example.
- c) Describe Hadoop Architecture with a neat diagram.
- d) Describe about Generic XML database architecture with a neat diagram.
- e) Describe Hive Architecture with a neat diagram.

O P JINDAL UNIVERSITY, RAIGARH (C.G.)



MID SEMESTER EXAMINATION, MAY-2022

Business Intelligence & Machine Learning

[SOE-M-CSE202]

M. Tech. - 2nd Sem.

TIME : 02 Hrs

Branch: (Computer Science & Engineering)

MAX MARKS : 50

Note:

Q1 All Questions are compulsory [1 mark x 5]

- Define Machine Learning.
- What is dimensionality reduction?
- What is clustering?
- Define ensemble techniques.
- Define outlier in a dataset. What is its application?

Q2 Answer any six questions [4 marks x 6]

- Differentiate between machine learning and traditional programming.
- What is reinforcement learning? Explain with example.
- What is unsupervised learning? Explain with example.
- Discuss Artificial Neural Network with suitable diagram.
- Describe simple linear regression.
- What is confusion metrics? Define the terms TP, TN, FP and FN.
- Differentiate between classification and regression?

Q3 Answer any three questions [7 marks x 3]

- What is bayes theorem? Describe Naïve Bayes classifier in detail.
- Classify the tuple
 $X = \{\text{age}=\text{youth}, \text{income} = \text{medium}, \text{student} = \text{yes}, \text{credit_rating}=\text{fair}\}$
with the help of Naïve Bayes classifier. Use following dataset.

RID	age	income	student	credit_rating	Class: buys_computer
1	youth	high	no	fair	no
2	youth	high	no	excellent	no
3	middle_aged	high	no	fair	yes
4	senior	medium	no	fair	yes
5	senior	low	yes	fair	yes
6	senior	low	yes	excellent	no
7	middle_aged	low	yes	excellent	yes
8	youth	medium	no	fair	no
9	youth	low	yes	fair	yes
10	senior	medium	yes	fair	yes
11	youth	medium	yes	excellent	yes
12	middle_aged	medium	no	excellent	yes
13	middle_aged	high	yes	fair	yes
14	senior	medium	no	excellent	no

c) Find out whether the person whose details are mentioned in the tuple X has diabetes or not using K-Nearest Neighbor classifier. Use following dataset. Assume K=5.

$X = \{\text{age} = 42, \text{Fasting Sugar Level} = 74, \text{PP sugar Level} = 184\}$

S.No.	Age	Fasting Sugar level	PP Sugar level	Diabetic
1	30	70	289	Yes
2	34	78	125	No
3	56	80	122	No
4	78	81	233	Yes
5	45	82	200	Yes
6	68	88	198	Yes
7	43	67	159	No
8	44	75	153	No
9	67	80	128	NO
10	56	84	132	Yes

d) Define K - Means Clustering Technique using an example.

e) Describe Hierarchical clustering algorithm with the help of an example.

SUBJECT Signal Processing and Data Analytics [SOE-M-CSE203(1)]

COURSE MTech- II Semester

TIME : 02 Hrs

BRANCH CSE

MAX MARKS : 60

Note: Please write pointwise in neat and clean manner.

Q1 All Questions are compulsory [2 marks x 6]

- a) What do you mean signal?
- b) Define Shift-Invariant system.
- c) Define symmetric and antisymmetric signal
- d) Define dynamic and static system
- e) What is zero padding? What are its uses?
- f) State Periodicity Property of DFT.

Q2 Answer any six questions [4 marks x 6]

- a) Explain transform and spatial domain of signal.
- b) What are the different areas in which signal processing can be applied?
- c) What is Discrete Time Systems?
- d) Explain DFT.
- e) Distinguish between Fourier series and Fourier transform.
- f) Distinguish between periodic and aperiodic signals.
- g) What is the need for DFT algorithm?

Q3 Answer any three questions [8 marks x 3]

- a) What are the steps involved in digital signal processing? Explain each in brief.
- b) How continuous signal can be converted into digital signal. Explain sampling and quantization process?
- c) Explain Fourier transform and inverse Fourier transform.
- d) Explain Fast Fourier Transform with suitable example.
- e) What are the different types of signals available? Explain each in brief.

Cloud Computing and Applications [SOE-M-CSE204 (1)]

M. Tech. – 2nd Sem.

TIME : 02 Hrs

Branch: Computer Science and Engineering

MAX MARKS : 50

Note:

Qu1. Solve all questions. Each question having equal marks. [5 Questions X 1 Mark]

- Which of these should a company consider before implementing cloud computing technology?
 - Employee satisfaction,
 - Potential cost reduction
 - Information sensitivity
 - All of the above
- _____ is a central configuration repository where in all the meta-data and configuration of different modules, resources are kept and updated on a real-time basis
 - storage
 - virtual machine
 - Configuration Management Database
 - System Infrastructure Database
- The elasticity and the flexibility in the Cloud are built on the foundation of _____.
- Cloud deployment models are IaaS, PaaS and SaaS.
 - True
 - False
- An Internet connection is necessary for public cloud computing interaction.
 - True
 - False

Qu2. Solve any six question. Each question having equal marks. [6 Questions X 4 Mark]

- What is virtual machine? Write any two advantages of virtual machine?
- What are the different service management that cloud improves?
- Write any four advantages of cloud computing?
- What are the different business values of cloud computing?
- Explain CAPEX and OPEX?
- What do you understand by cloud workload and workload lifespan?
- What is hybrid cloud?

Qu3. Solve any three question. Each question having equal marks. [3 Questions X 7 Mark]

- How cloud computing helps to reduce the issues from traditional IT infrastructure?
- State the different cloud computing technological values?
- What does cloud computing change for the provider?
- What are the pros and cons of cloud deployment architectures?
- What decision factors helps to opt cloud deployment models?

XXXXXXXX

Power Electronics Controlled Electric Drives [SOE-M-PEP201]

M. Tech. -2nd Sem. (EE)
(Power Electronics & Power Systems)

TIME: 02 Hrs
MAX MARKS: 50

Q1. Solve the following question (Any four)

2 X 4 = 8

- What is Electric Drive? What are the components of it?
- What are advantages of Electric drives over other types of drives?
- Derive fundamental torque equation of an Electric drive.
- On what principle unbalanced capacitor braking of a 3 phase Induction motor works?
- Compare between ac & dc drives.

Q2. Solve the following question (Any three)

5 X 3 = 15

- What factors are considered for selection of a drive? Explain.
- What is steady state stability of a drive? Find the condition for steady state stability of a drive.
- What are different methods of speed control of dc motors? Explain.
- Explain about dc dynamic braking of dc motor.
- Explain about constant torque and constant power operation of a drive.

Q3. Solve the following question (Any three)

9 X 3 = 27

- Explain about single phase fully controlled rectifier fed dc drive in both mode of operation continuous and discontinuous.
- Explain four quadrant operation of an electric drive.
- Explain variable voltage variable frequency control of Induction motor. Why this method of speed control is frequently used in industries.
- Explain dc motor chopper control, one quadrant operation only.
- What are different methods under slip power recovery scheme of Induction motor? What are advantage and disadvantages of them?

POWER SYSTEM DYNAMICS & CONTROL [SOEM-PEP202]

M.Tech- 2nd Sem. (EEE)

TIME: 02 Hrs

MAX MARKS: 50

Note: Q1 is compulsory

Q1

Answer all

10×2 = 20

- i Explain voltage stability
- ii Write definition of power system stability?
- iii What are the methods which are using steady state stability limit of a power system?
- iv What is Frequency stability?
- v What is Torsional Oscillation?
- vi Differentiate between steady state and transient stability?
- vii Define SCR of synchronous machine?
- viii Explain critical clearing angle and critical clearing time.
- ix Explain the importance DQ0 transformation in synchronous machine modelling
- x Why power system stabilizer is used?

Q2

Answer any three

3×10=30

- i Define power system stability with details classification and explanation
- ii Derive Swing equation and explain how stability can be analysis using swing equation
- iii Derive the power angle equation for SMIB system and draw the P-V and P-δ curve
- iv Explain equal area criterion and methods to improve the transient stability

Subject: Microprocessor Applications in Power Electronics [SOE-M-PEP 203]

Course & Sem – M Tech (PE & PS), 2nd Semester

Time : 02 Hrs

Branch: Electrical Engineering

Max. Marks:50

Q1 All Questions are compulsory [2 mark x 5]

- a) In which Motor rotating magnetic field will be generated?
- b) How Many Types of Induction Motors?
- c) What is the difference between Synchronous Motor and Variable Reluctance Motor
- d) Specify the various types of PWM techniques are there
- e) What is the Importance of the d-q reference frames

Q2 Answer any Six Questions [4 marks x 6]

- a) Per Phase Equivalent circuit for Induction Motor is an essential factor to get the modelling of it, Describe the equivalent Motor circuit with all its mathematical modelling.
- b) Speed Torque characteristics will decide the performance of the induction motor. So how do you prove it?
- c) Explain the V/F Operation of an Induction Motor
- d) What do you understand about the Harmonic effects in an Induction Motor, and How do you overcome them with the reactive power.
- e) Pulsating Torque in the airgap of the Induction Motor may change its frequency. What do you understand by this statement? Describe it with equations.
- f) What is the concept of DSP implementation in A/D conversion? Explain with the mathematical equations
- g) Derive an equation for the linear and time-invariant modelling for the circuits
- h) How do you justify the rotating magnetic field distribution in an Induction Motor? Explain with a neat diagram

Q3 Answer any Two Questions [8 marks x 2]

- a) What do you understand by PLL and derive an equation for the Charge Pump
- b) Derive an equation for the Voltage Controlled Oscillator
- c) How many types of Modulations? What do you know about the Space Vector PWM

Circuit Simulation in Power Electronics [SOE-M-PEP204(3)]

M. Tech. – 2nd Semester

TIME: 02 Hrs.

Electrical Engineering

MAX MARKS: 60

Q1 All Questions are compulsory [2 marks x 6]

- Define phase control.
- Define the delay angle of phase-controlled rectifier.
- Derive the expression for average output voltage of full wave mid-point converter with R-load.
- What are the advantages of freewheeling diode in controlled rectifier?
- With neat sketch, draw the output voltage waveform of single-phase semi-converter?
- Define the value of conduction angle for single phase half wave phase-controlled rectifier with R-L load.

Q2 Answer any six questions [4 marks x 6]

- What are the differences between half-controlled and fully controlled bridge rectifiers?
- What is the output voltage for the triggering angle $\alpha=90^\circ$ in a single-phase 230V half controlled converter?
- A single phase half wave converter is operated from a 120V, 60Hz supply. If the load is resistive of value 10Ω and delay angle is $\alpha= \pi/3$. Determine the output DC power
- Design a circuit to produce an average voltage of 40V across a 100Ω load resistor from a 120V rms, 60 Hz ac source. Determine firing angle?
- A single phase half wave rectifier is used to supply power to a load of impedance 10Ω from 230V, 50Hz, AC supply at the firing angle of 30° . Calculate the load current?
- Derive the expression for average output voltage of synchronous full wave bridge rectifier?
- Explain half wave rectifier for R load with suitable diagram of output voltage and current.

Q3 Answer any three questions [8 marks x 3]

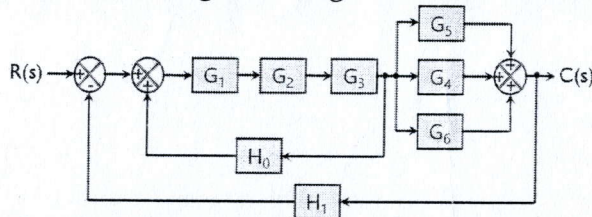
- By using MATLAB, simulate half wave controlled diode rectifier with R-load and plot output voltage waveform
- By using MATLAB, simulate phase controlled half wave rectifier with RL-load and plot output voltage waveform
- By using MATLAB, simulate full wave controlled bridge rectifier with R-load and plot output voltage waveform
- By using MATLAB, simulate full wave diode bridge rectifier with RL-load and plot output voltage waveform.
- With neat sketch, describe the function of asynchronous full wave controlled bridge rectifier with resistive and inductive load. What will be the waveforms observed?

Q1 All Questions are compulsory [2 marks x 6]

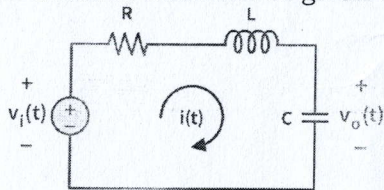
- Define closed loop transfer function with examples.
- Define the transfer function of a system
- What is time response and steady state response system?
- Define (i) Speed of response (ii) Fidelity
- Define Accuracy and precision.
- The current through a resistor is 5A, but the measurement yields a value of 4.9A. Calculate the absolute error and the percentage error of the measurement.

Q2 Answer any six questions [4 marks x 6]

- The following values are obtained from the measurements of the value of a resistor: 147.2, 147.4, 147.9, 147.1, 147.5, 147.6, 147.4, 147.6, 147.5. Calculate (i) Arithmetic mean (ii) Average deviation and (iii) Standard Deviation
- Reduce the block diagram in fig and obtain its transfer function.



- Derive an expression for response of 1st order system for unit step input
- Explain how the control system are classified?
- Explain the significance of a transfer function stating its advantages and features.
- Find the transfer function of given system



- Derive the transfer function of simple closed loop system

Q3 Answer any three questions [8 marks x 3]

- A system has the following transfer function, determine its unit impulse, step and ramp response with zero initial conditions. Sketch the responses.

$$\frac{C(s)}{R(s)} = \frac{20}{s + 10}$$

- Derive the steady state error and find the steady state error for step input.
- A unity feedback system has $G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$; determine type of the system, All error coefficients, and error for ramp input with magnitude 4.
- Draw the block diagram of the measuring system and explain the function of each stage of the system.
- What are the various sources of gross, systematic and random errors in the measuring instruments? How those errors are minimized?



M.Tech. -2nd Semester (Mechanical)

TIME: 02 Hrs.

[Power Plant Engineering & Energy Management]

MAX MARKS: 50

Note: Write all questions of one part at one place

Q1. All Questions are compulsory [1 marks x 5]

- Write the name of major components of steam cycle.
- Write the name of cycle on which steam power plant operates.
- Classify the steam turbine according to the action of steam.
- Write the name of blade geometry used in preparing reaction turbine blades.
- Name the two location of internal energy loss in steam turbine.

Q2. Answer any six questions [4 marks x 6]

- Classify the steam turbine on the basis of various aspects of steam turbine.
- Draw the schematic diagram of heat cycle of steam turbine power plant with T-s diagram
- Explain the nuclear power plant in brief.
- Differentiate the impulse and reaction turbine.
- Explain the steam governing and write the types of steam governing.
- Define degree of reaction and write the mathematical equation.
- Draw the pressure and velocity variation graph for steam flow through impulse turbine.

Q3. Answer any three questions [7 marks x 3]

- Explain the principle elements of steam turbine.
- Explain the principle of steam turbine with velocity diagram of blade.
- Explain the working of nozzle governing with neat sketch.
- In a De-Laval turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20° , the mean blade velocity is 400 m/s, and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1000 kg & the blade velocity coefficient = 0.8. Calculate: (i) Blade angles. (ii) Relative velocity of steam entering the blades. (iii) Tangential force on the blades.
- A certain stage of a Parson's turbine consists of one row of fixed blades and one row of moving blades. The details of the turbine are as below: The mean diameter of the blades = 68 cm R.P.M. of the turbine = 3000. The mass of steam passing per sec = 13.5 kg, Steam velocity at exit from fixed blades = 143.7 m/s. The blade outlet angle = 20° . Calculate the power developed in the stage and gross efficiency, assuming carry over coefficient as 0.74 and the efficiency of conversion of heat energy into kinetic energy in the blade channel is 0.92.



OPJU O P JINDAL UNIVERSITY, RAIGARH (C.G.)

MID SEMESTER EXAMINATION, MAY- 2022

Design of Heat Exchanger SOE-M-PPE203

M. Tech. - II Semester
Mechanical Engineering

TIME: 02 Hrs
MAX MARKS : 50

Note : HMT Databook is allowed

Q1 Write in short

(5 M)

- What do you mean by the profile of fins.
- What do you mean by the plate-fin heat exchanger.
- What do you mean by the effectiveness of fins
- How fins increase the heat transfer rate.
- What do you mean by efficiency of fins?

Q2 Solve any six questions

(24 M)

- An engine is fitted with pin fins having thermal conductivity $k = 200 \text{ W/mK}$. The diameter and length of the fin is 2 cm and 50 cm respectively. Calculate the temperature at 10 cm from the fin base if fin base temperature is 500°C and fin is in contact with air at 50°C . Take $h = 12 \text{ W/m}^2\text{K}$.
- Longitudinal fins of triangular profiles are exposed to ambient temperature at 30°C with a heat transfer coefficient $40 \text{ W/m}^2\text{K}$. The base temperature is 127°C and the thermal conductivity of fin is 30 W/mK . The fin length is 14 cm and thickness at the base is 1.2 cm. Determine the temperature at the tip of the fin and heat transfer from the fin
- Give a suitable classification for heat exchangers
- Derive an expression for temperature distribution on a triangular fin from the general expression of fin.
- One hundred circumferential fin aluminum fin are mounted on a 1m tube and have an OD of 2.5 cm. The fins are 1 cm and 2 mm thick. The base temperature is 180°C and the surrounding temp is 20°C with $h = 50 \text{ W/m}^2\text{K}$. Calculate the heat loss.
- What do you mean by annular fins. Explain with diagram
- Find the heat transfer rate from a hot surface for 6 fins of 10 cm length? The base temperature of the fin is maintained at 200 degree Celsius and the fin is exposed to a convection environment at 15 degree Celsius with a convective coefficient of $25 \text{ W/m}^2\text{K}$. Each fin has a cross-sectional area of 2.5 cm^2 and is made of a material having thermal conductivity of 250 W/m K

Q 3 Solve any three questions

(21 M)

- a) A circumferential fin of rectangular profile is made up of material having thermal conductivity 55 W/mK . The fin is installed on a tube having diameter of 3 cm and the length of the fin is 3 cm and thickness 2 mm . If the fin is exposed to a convection coefficient at 20°C with $h = 68 \text{ W/m}^2\text{K}$ and the tube wall temperature is 100°C . Calculate the heat transfer by the fin.
- b) Annular steel ($k = 40 \text{ W/mK}$) fins, 15 mm long and 2 mm thick are provided on a tube of diameter 30 mm . The tube surface temperature is 210°C and the ambient temperature is 25°C . Estimate the heat transfer from one fin if the convective heat transfer coefficient between the fin and the air is $30 \text{ W/m}^2\text{K}$.
- c) Derive an expression for obtaining the general expression of fin and obtain the temperature distribution for longfin.
- d) A triangular fin is made up of Aluminium and measures 1 cm in length, 0.8 cm in width and 0.3 cm in thickness. The base temperature is maintained at 80°C . Assume the ambient temp is 20°C with a convective heat transfer coefficient of $12 \text{ W/m}^2\text{K}$. The conductivity of Aluminium fin is 200 W/mK . Calculate the heat transfer and fin efficiency.

COMPUTATIONAL FLUID DYNAMICS [SOE-M-PPE204]

M. Tech. – 2nd Sem. (MECH)

TIME: 02 Hrs

(Power Plant Engineering & Energy Management)

MAX MARKS: 50

PART - I (All questions are compulsory) (1*5 = 05 Marks)

1. Explain the basic difference between Eulerian and Lagrangian approach. (1)
2. What do you understand by the Neuman boundary condition? (1)
3. What is CFD and state its objective? (1)
4. List down the different types of forces encountered by a fluid during flow. (1)
5. Explain the physical significance of divergence of velocity vector ($\nabla \cdot V$) (1)

PART - II (Attempt any 6 questions) (4*6 = 24 Marks)

6. In order to dissipate heat, a fin is attached to the base surface and the other end is free and insulated. For this situation identify the type of boundary condition with a valid reason. (4)
7. List down the major application areas of CFD. (4)
8. What are the differences between solving a fluid-flow problem analytically compared with solving numerically? What are the advantages and disadvantages of each method? (4)
9. Mention the key advantages of CFD technique. (4)
10. How can CFD be used and applied for cost effective design procedures in power plant industry? (4)
11. What are the different ways of choosing a fluid element and how does it affect the final form of governing equation? (4)
12. Explain the significance of Reynolds Transport theorem; also derive an expression for the same. (4)

PART - III (Attempt any 3 questions) (7*3 = 21 Marks)

13. Give a detailed classification of partial differential equations and mention basic characteristics of each. Identify the nature of the given partial differential equation. (7)

$$\frac{\partial c}{\partial t} + u \frac{\partial c}{\partial x} = D \frac{\partial^2 c}{\partial x^2} - Kc^{1.25}$$

14. Explain in detail the different types of boundary conditions encountered in CFD. (7)
15. Write a force balance equation for all the forces acting on a differential control volume and derive the equation for conservation of linear momentum. (7)
16. Derive the general form of energy equation (7)
17. Derive the Navier-Stoke's equation of fluid flow. (7)

O P JINDAL UNIVERSITY, RAIGARH (C.G.)

MID SEMESTER EXAMINATION, MAY-2022



Modelling and Simulation in Metallurgical and Materials Processing

[SOE-M-MST201]

M. Tech. - 2nd Sem. (META)
(Metallurgical and Materials Engineering)

TIME: 02 Hrs
MAX MARKS: 50

Note:

5 Questions x 1 Marks = 5 Marks

- Q1: What is the dimension of a billet?
Q2: Name 5 types of sand?
Q3: Name 4 metal forming process?
Q4: Name a four NDT methods for testing defects.
Q5: What is recrystallization temperature.

6 Questions x 4 Marks = 24 Marks [Out of 7 questions]

- Q6: What do you mean by mathematical modeling? Describe advantage and limitations.
Q7: Write the final form for Von-Mises and Tresca yielding criterion.
Q8: Describe thermit welding? Describe the role of sheilding gas in welding process?
Q9: Differentiate between casting, joining and forming with examples.
Q10: Explain hot and cold rolling of metals. Advantages and disadvantages.
Q11: What is heat-affected-zone?
Q12: Define ageing with respect to heat treatment? Describe Hall-Petch equation.

3 Questions x 7 Marks = 21 Marks [Out of 5 questions]

- Q13: What is Industry 4.0? Describe the role of computational tools in manufacturing processes. Explain importance of artificial intelligence in industry.
Q14: Draw a neat sketch of a pattern/mound, label various parts and explain it's roles.
Q15: Draw a neat sketch of an ingot and show different type of segregation.
Q16: NUMERICAL
Yield strength σ_y of a material is 850 MPa. Will the material yield?
Explain your answer with respect to Von Mises and Tresca yielding criterion.

$$\sigma_p = \begin{vmatrix} 90 & 0 & 0 \\ 0 & -400 & 0 \\ 0 & 0 & -910 \end{vmatrix}$$

- Q17: Determine the amount of oxygen that needs to be blown in Hot metal in order to achieve the target composition of carbon in steel.

Hot Metal							STEEL COMP			
HM wight	Scrap w	HM Si%	HM C%	HM P%	HM S%	HM Mn%	Steel C%	Steel P%	Steel Mn%	Steel S%
166.4	10	0.771	4.39	0.167	0.005	0.03	0.04	0.025	0.025	0.01



O P JINDAL UNIVERSITY, RAIGARH (C.G.)

MID SEMESTER EXAMINATION, MAY-2022

IRON AND STEEL MAKING TECHNOLOGY (SOE-M-MST202)

M.Tech –II Semester
MATERIAL SCIENCE & TECHNOLOGY

TIME: 02 Hrs
MAX MARKS: 50

Note: PART-I is compulsory.

PART-I

5 X 1M = 5M

- Q1. What are the raw materials required for iron making?
- Q2. Mention the chemical formulae of (i) Hematite (ii) Goethite (iii) pyrite (iv) Ilmenite
- Q3. What is meant by coalification of coal?
- Q4. What we find out in coal through proximate and ultimate analysis?
- Q5. What is the function of flux in blast furnace? What are the various fluxes added in the BF?

Attempt any SIX questions from PART-II

PART-II

6 X 4M = 24M

- Q1. Mention the sequence of operations for coke making process. What is meant by nut coke? [3+1]
- Q2. List various Raw material handling systems and mention its functions [4M]
- Q3. Define the term Metallurgical coal. Why coal is not used as fuel inside Bf? What is meant by coke? What are the functions of coke inside the BF? [1+1+1+1]
- Q4. Calculate % Fe in Fe_2O_3 , Fe_3O_4 [2+2]
- Q5. Explain about Petrological constituents of coal [4M]
- Q6. List various coal beneficiation processes and explain any **one** wet separation method [1+3]
- Q7. Explain about CSN calculating procedure for coal [4M]
- Q8. What is the significance of bulk density parameter in coke making? List various Precarbonization techniques. [2+2]

Attempt any Three questions from PART-III

PART-III

3 X 7M = 21M

- Q1. What is the difference between recovery and non-recovery coke ovens? What kind of refractory bricks are used and why? Mention the behavior of coal at different temperatures inside the oven [2+2+3]
- Q2. Explain the coke quenching cycle. Mention the size of the coke used for BF and sinter. What are the various byproducts obtained from byproduct coke oven process? Mention the mode of heat transfer takes place in non-recovery ovens. [2+2+2+1]
- Q3. Explain about shatter and tumbler test done for coke. Define the term Run-of-mine. [3+3+1]
- Q4. Explain the **TWO** high temperature testing done for the coke. What is meant by freeboard? [3+3+1]
- Q5. Explain about merit and demerits of recovery and non-recovery coke oven process. Explain the principle of non-recovery coke oven. [(4*1.5M)+1 = 7M]

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OPTICAL FIBER OPTICS

PHYSICS DEPARTMENT

UNIVERSITY OF CALIFORNIA, SAN DIEGO

PHYSICS 440

LECTURE 10

DATE: _____

NAME: _____

SECTION: _____

PROFESSOR: _____

STUDENT ID: _____

1. Introduction to optical fibers

2. Total internal reflection

3. Numerical aperture

4. Dispersion in optical fibers

5. Attenuation in optical fibers

6. Coupling of light into fibers

7. Applications of optical fibers

8. Summary

9. Homework assignments

10. References

11. Additional resources

12. Contact information

13. Acknowledgments

14. Appendix A

15. Appendix B

16. Appendix C

O P JINDAL UNIVERSITY, RAIGARH (C.G.)

MID SEMESTER EXAMINATION, MAY-2022

MATERIALS CHARACTERIZATIONS [SOE-M-MST203]



**M. Tech. - 2nd Semester (META)
MATERIALS SCIENCE & TECHNOLOGY**

**TIME : 02 Hrs
MAX MARKS : 50**

PART-I (Compulsory)

5 X 1M = 5M

- Q1. What is anisotropic material?
- Q2. Define 'Theory of light'?
- Q3. Mention the methods of image formation?
- Q4. How does secondary electron form?
- Q5. State Brag's Law?

Part-II (Any Six)

6 X 4M = 24M

- Q1. How do you minimize the spherical aberration of a lens?
- Q2. Differentiate between optical microscope and electron microscope.
- Q3. Mention the function of thermionic electron gun.
- Q4. State the terms "Elastic" and "Inelastic" scattering.
- Q5. With a schematic diagram discuss the volumetric interaction of electron beam in a material.
- Q6. State fundamental three steps to determine an unknown crystal structure.
- Q7. Differentiate between Laue method and Debye Scherrer method.

Part-III (Any Three)

3 X 7M = 21M

- Q1. With a schematic diagram discuss the specimen electron beam interaction.
- Q2. Discuss the steps involved in metallographic sample preparation.
- Q3. Show that in a simple cubic lattice the separation between successive lattice planes (100), (110) and (111) are in the ratio of 1:0.71:0.58.
- Q4. How do you calculate crystalline size through Scherrer expression?
- Q5. Discuss different types of material characterization techniques and related equipment.

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MID SEMESTER EXAMINATION, MAY-2022



Advanced Materials Processing [SOE-M-MST204]

M. Tech. – 2nd Sem. (META)
(Metallurgical and Materials Engineering)

TIME: 02 Hrs
MAX MARKS: 50

Note:

5 Questions x 1 Marks = 5 Marks

- Q1: What is the dimension of a bloom?
- Q2: Name 5 patterns?
- Q3: Name a laser that is used for cladding?
- Q4: Mention the types of grains in casting
- Q5: Name four casting defects?

6 Questions x 4 Marks = 24 Marks [Out of 7 questions]

- Q6: What are the advantages and disadvantages of casting? Name alternatives of casting.
- Q7: Differentiate between Von-Mises and Tresca yielding criterion.
- Q8: What is segregation? Name types of segregation, its cause and remedy.
- Q9: Explain the need for laser processing of material.
- Q10: Describe various rolling mill like 2-HI, 3-HI, Tandem etc. Draw sketch.
- Q11: What is the purpose of alloying? Describe role of alloying components in steel?
- Q12: What is flow stress? Explain the difference between elastic and plastic deformation.

3 Questions x 7 Marks = 21 Marks [Out of 5 questions]

- Q13: Explain rate of solidification? Chvorinov's rule?
- Q14: Draw a stress-strain diagram for ductile and brittle material. Describe various region of stress-strain curve for a ductile material.
- Q15: Explain the role of temperature and strain rate on stress strain diagram. Correlate it with metal forming processes like rolling, forging, extrusion etc.
- Q16: Describe NDT processes for examining defects in finished products (cast, rolled and forged products).
- Q17: Differentiate between cold and hot working? Describe advantages and disadvantages.

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M.D. SEMESTER EXAMINATION, MAY-2022

Advanced Materials Processing (2021-M-KST-202)

Roll No. _____

M. Tech - 5th Sem (MTEA)

DATE MARKED: _____

(Duration: 3 hours)

Section - I (Short Answer Questions)

Q1. Define the term 'Advanced Materials'.

Q2. List the characteristics of advanced materials.

Q3. Explain the importance of advanced materials in modern technology.

Q4. Discuss the role of advanced materials in the automotive industry.

Q5. What are the challenges associated with advanced materials?

Section - II (Long Answer Questions)

Q6. Discuss the various methods used for the synthesis of advanced materials.

Q7. Explain the role of advanced materials in the development of smart structures.

Q8. Discuss the impact of advanced materials on the environment.

Q9. Explain the role of advanced materials in the development of renewable energy systems.

Q10. Discuss the role of advanced materials in the development of nanotechnology.

Section - III (Short Answer Questions)

Q11. Define the term 'Advanced Materials'.

Q12. List the characteristics of advanced materials.

Q13. Explain the importance of advanced materials in modern technology.

Q14. Discuss the role of advanced materials in the automotive industry.

Q15. What are the challenges associated with advanced materials?