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

MID SEMESTER EXAMINATION, DECEMBER - 2021

Introduction to Earthquake Engineering & SOE-M-SE101

M.Tech. (CIVIL)-1st Semester TIME : 02 Hrs

[STRUCTURAL ENGINEERING] MAX MARKS : 30

Q1. All questions are compulsory. (10×1=10)

a) What is Seismology ?
b) What is an earthquake?
c) Define Impedance ratio.
d) What is an accelerometer?
e) Why do earthquakes happen?
f) Write the necessary component of a strong motion instrumentation.
g) Write three ground motion parameters .
h) Where do earthquakes happen?
i) Write the equation for the energy released during an earthquake.
j) Which type of seismic wave does not pass through a fluid?
(i) Surface wave
(ii) Body wave
(iii) S-wave
(iv) P-wave

Q2. Answer any five questions. (5×2=10)

a) What are the formulae for P and S velocity?
b) What are different types of faults?
c) What is an attenuation relationship?
d)What is Gutenberg-Richter relationship?
e) What is a DVA spectrum?
f) Write different types of plate boundaries.

Q3. Answer any two questions. (2×5=10)

a) Describe different factors that are responsible for ground motion modification.
b) Write the general steps for generation of a uniform hazard spectrum.
c) Write short note on (i)Crust (ii) Mantle
d) Estimate the moment magnitude of an event with rupture length of 100km, rupture width of 45km and slip of average fault slip of 3m. Take modulus of rigidity (mu) as 3.5×10^{10} N/m^2.

Best of Luck

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

Advanced Solid Mechanics (SOE-M-SE102)

M. Tech. (CIVIL) - 1st Semester TIME: **02 Hrs.**

[STRUCTURAL ENGINEERING] MAX MARKS: **30**

Note: If any data is missing, then assume it and mention it at the starting point of your answer.

Answer Any Three (10 × 3)

Q1. (a) Three state of stress at a point is such that $\sigma_x = \sigma_y = \sigma_z = \tau_{xy} = \tau_{xz} = \tau_{yz} = \rho$. Determine the principal stresses and their directions. [4]

(b) The state of stress at a point is characterized by $\sigma_x = 18$, $\sigma_y = -50$, $\sigma_z = 32$, $\tau_{xy} = 0$, $\tau_{xz} = 24$, $\tau_{yz} = 0$ (all in units of kPa). Calculate the principal stresses and the direction of largest principal stress? [6]

Q2. (a) Write the generalized Hooke's law for an isotropic material? [5]

(b) A cubical element is subjected to the following state of stress. [5]

$\sigma_x = 100$ MPa, $\sigma_y = -20$ MPa, $\sigma_z = 40$ MPa, $\tau_{xy} = 0 = \tau_{xz} = \tau_{yz}$.

Assuming the material to be homogenous and isotropic, determine the principal shear strains and the octahedral shear strain. Take E = 210 GPa and $\nu = 0.30$.

Q3. The following state of strain exists at a point P

$$[\varepsilon_{ij}] = \begin{bmatrix} 0.02 & -0.04 & 0 \\ -0.04 & 0.06 & -0.02 \\ 0 & -0.02 & 0 \end{bmatrix}$$

(a) In the direction PQ having direction cosines $n_x = 0.6$, $n_y = 0$ and $n_z = 0.8$, determine ε_{ij}? [2]

(b) What is the cubical dilation at a point P? [2]

(c) Determine the principal strains and the directions of the maximum and minimum principal strains. [6]

Q4. (a) What do you mean by Lame's coefficients? [2]

(b) Express the shear modulus and bulk modulus in terms of Young's modulus (E) and Poisson's ratio (ν)? [2]

(c) What do you mean by the state of pure shear? [2]

(d) Write down differential equations for equilibrium for 3D state? [2]

(e) What do you mean by the plane state of stress? [2]

Q5. (a) What are the different kinds of theories of failure? [2]

(b) Discuss different theories of failure (any four) and their significance? [4×2]

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

MID SEMESTER EXAMINATION, DECEMBER – 2021

STRUCTURAL DYNAMICS [SOE-M-SE103]

M. Tech. (CIVIL)-1st Semester
[STRUCTURAL ENGINEERING]

TIME: **02 Hrs**
MAX MARKS: **30**

Que 1) All compulsory Question

a) Damper used for_____ **1**
- i) Free vibrational system
- ii) Forced vibrational system
- iii) All of above
- iv) None of above

b) Structural dynamics suitable for_ **1**
- i) Vibrational system
- ii) Earthquake system
- iii) All of above
- iv) None of above

c) Free vibration is_____ **1**
- i) initial condition t=0
- ii) No force applied
- iii) referring simple undamped oscillator
- iv) All of above

d) In one degree of freedom system neglect frictional forces. **1**
TRUE
FALSE

e) In continuous structure have _____ degree of freedom **1**
- i) 3
- ii) 9
- iii) 12
- iv) Infinite

f) What is single degree of freedom? **1**

g) What do you mean by free body diagram? **1**

h) D' Alembert's principle based on principle of____ **1**
- i) Motion
- ii) Virtual work
- iii) Work done
- iv) None of above

i) Viscous damping is **1**
- i) Imaginary
- ii) Realistic
- iii) Actual
- iv) None of above

j) Free falling pendulum is _____ motion **1**
- i) Free vibrational
- ii) Forced vibrational
- iii) None of above
- iv) All of above

Que 2) Solve any Five

a)	Write down the Newtons 2nd Law of motion?	**2**
b)	Write down the D'Alembert's principle?	**2**
c)	Write down elementary parts of vibrating system?	**2**
d)	What is viscous damping?	**2**
e)	Explain the types of vibrations?	**2**
f)	What are the equations of simple pendulum system?	**2**

Que 3) Solve any Two

a)	Explain springs in parallel and in series with diagram and equations?	**5**
b)	Explain solution of differential equation of motion?	**5**
c)	Explain harmonic excitation for damped system?	**5**

********BEST LUCK********

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

STRUCTURAL OPTIMIZATION [SOE-M-SE105(2)]

M. Tech. – 1st Semester
CIVIL

TIME : **02 Hrs**
MAX MARKS : **30**

Part- 1

Q.1: Attempt any five of the following questions-: **(2*5=10 Marks)**

1. Explain graph embedding method to extract the features of bar members of truss?
2. What is force density method for simultaneous optimization of topology and geometry of a truss?
3. Why the circular and the hollow circular sections are best for the torsion?
4. State in brief how Reinforcement Learning can be applied in Structural Optimization?
5. Explain design variables in optimization problem formulation using some example?
6. Explain constraints in optimization problem using some example?

Part 2

Q.2. Answer any FOUR of the following questions **(2.5*4=10 Marks)**

1. Minimize f(x) subject to g_j (x) >= 0, j=1,2,3,...J; // h_k (x) = 0, k=1,2, ... K; // Xi(L) <= xi <= xi (U), I = 1,2,....N.
2. Minimize f(x) subject to g_j (x) >= 0, j=1,2,3,...J; // h_k (x) = 0, k=1,2, ... K; // Xi(L) <= xi <= xi (U), I = 1,2,....N.
3. Explain optimality criteria
4. What is inflection point?
5. Minimize the below;

$$\text{minimize} \quad \frac{\max \text{abs q2 (t)}}{A}$$

Subject to

18 - max q2 ''' (t) >= 0

0 <=kfs, krs <=2

0<= alpha f, alpha r <=300

Part 3

Q.3. Answer the following questions

(Solve Any TWO) **(5*2=10 Marks)**

1. Explain topology optimizatation of elasto-plastic materials and structures?
2. What is Solid Isotropic Material with Penalization (SIMP)? Explain
3. What is Diagrids and hexagrids?
4. Why is it difficult to apply Convolutional Neural Networks to Discrete Structures?

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

MID SEMESTER EXAMINATION, DEC - 2021

Advanced Mathematics [SOE-M-CSE101]

MTech-I[st] Semester | CSE | *Time: 2 hour* | Maximum Marks: 30

1. Answer all questions. [1×5

   (a) Find the Fourier sine transform $f(x) = x$

   (b) Show that the vectors (1, 2) and (-3, -6) are linearly dependent.

   (c) Find the sum of the eigen values of the matrix $\begin{bmatrix} 8 & 3 \\ 2 & 7 \end{bmatrix}$.

   (d) Write the Parseval's formula for Fourier Transform.

   (e) Write the conditions for Fourier Expansion.

2. Answer any five questions? [2×5

   (a) Express $f(x) = x$ in half range sine series in $0 < x < 2$.

   (b) If Fourier transform of $e^{-x^2/2}$ is $\sqrt{2\pi}\, e^{-s^2/2}$, then find the Fourier transform of e^{-2x^2}.

   (c) Find the inverse Fourier cosine transform of $e^{-\pi s}$

   (d) Solve by Gauss elimination method: $x + y = 1;\ -x + y = 1$

   (e) Express $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$ as a linear combinations of $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $\begin{bmatrix} 3 \\ 5 \end{bmatrix}$.

   (f) Check whether the vectors are linearly dependent or independent: (1,0,2),(-1,1,2),(-2,3,1) and (2,1,1)

3. Answer any three questions? [5×3

   (a) Find the Fourier series of $f(x) = x \sin x,\ \ 0 < x < 2\pi$

   (b) Find the Eigen values and corresponding eigen vectors of the matrix

$$\begin{bmatrix} -1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 2 & -1 \end{bmatrix}$$

   (c) Define norm and inner product of a vector space.
   If an inner product is defined as

$$\langle f,\ g \rangle = \int_{-\pi}^{\pi} f(t) \cdot g(t)\, dt$$

   show that $\{1, \cos t, \sin t\}$ is an orthogonal set and find its orthonormal set.

   (d) Find an orthonormal set of vectors(in R^4) for (1,0,1,1), (-1,0,-1,1), (0,-1,1,1)

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

ADVANCE DATA STRUCRURES & ALGORITHMS – SEO-M-CSE102

M.Tech. (Computer Science & Engineering)-1st Semester — TIME : 02 Hrs

[ADVANCE DATA STRUCRURES & ALGORITHMS] — MAX MARKS : 30

Note : Attempt any 10 questions from Part-A. Part-B Carries 2-marks each.
Attempt any 2 questions from Part-B. Part-B Carries 5-marks each.

Part-A

a) What do you mean by Data Structures? Briefly provide details about different types of data structures?
b) What is linked list? What are the pros and cons of linked list over array data structure?
c) Explain overflow condition in linked list data structure?
d) Explain underflow condition in linked list data structure?
e) What do you mean by stack? What are the basic operations of the stack?
f) Explain Two-way list with the help of suitable diagram?
g) Discuss the one-way list or singly linked list representation of stack?
h) Explain recursion with suitable examples?
i) Consider the following arithmetic expression P, written in postfix notation:

P: 12, 7, 3, -, /, 2, 1, 5, +, *, +

(i) Translate P, by inspection and hand, into its equivalent infix expression.
(ii) Evaluate the infix expression.

j) Consider the following infix expression Q and translate into its equivalent postfix expression P.

Q: ((A + B) * D) ^ (E – F)

k) Translate, by inspection and hand, each infix expression into its equivalent prefix expression:
   i. (A-B) * (D/E)
   ii. (A + B ^ D)/(E – F)+G

l) Let J and K be integers and suppose Q(J,K) is recursively defined by:

$$Q(J, K) = \begin{cases} 5 & if\ J < K \\ Q(J-K, K+2) + J & if\ J \geq K \end{cases}$$

Find Q(2,7) and Q(15,2).

Part-B

1. Discuss the process of inserting an element at the beginning and end of the linked list.

2. Provide detailed explanation on the deletion operation over Two-way linked list with suitable diagram and example?

3. Explain the followings:
   i) Linked list representation of stack.
   ii) Array representation of the stack.

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

Fundamental of Data Analytic's & SOE-M-CSE103

M.Tech (Sec B)-1st Semester TIME : **02 Hrs**

Computer Science and Engg. Code SOE-M-CSE103 MAX MARKS : **30**

Q1. Answer any 10 from the following questions (carrying 1 mark each).

a) "_____ is a subject-oriented, integrated, time-variant, nonvolatile collection of data in support of management decisions.

I. Data Mining.

II. Data Warehousing.

III. Web Mining.

IV. Text Mining.

b) The data Warehouse is_____.

I. read only.

II. write only.

III. read write only.

IV. none.

c) Expansion for DSS in DW is_____.

I. Decision Support system

II. Decision Single system

III. Data Storable System.

IV. Data Support System.

d) The important aspect of the data warehouse environment is that data found within the data warehous is

I. subject-oriented

II. time-variant

	for publishing onto the website /Social Media/News Letter. 2. Report of Co-curricular/extra- curricular activities and achievement of faculty and students. 3. Faculty publication records. 4. Provide data for Institute Website 5. Promote Dept. achievements Social Media / WhatsApp / Notice Boards
M .Tech Guide	1. Guide the M. Tech student. 2. Guide as well as help them to write the research paper and thesis.

III. integrated

IV. All of the above.

e) The time horizon in Data warehouse is usually _____.

I. 1-2 years.

II. 3-4years

III. 5-6 years.

IV. 5-10 years.

f) The data is stored, retrieved & updated in _____.

I. OLAP

II. OLTP.

III. SMTP.

IV. FTP.

g) _____describes the data contained in the data warehouse.

I. Relational data.

II. Operational data.

III. Metadata.

IV. Informational data.

h) _____predicts future trends & behaviors, allowing business managers to make proactive, knowledge-driven decisions.

I. Data warehouse.

II. Data mining.

III. Datamarts.

IV. Metadata.

Q. Design a HTML page describing your profile in one paragraph. Design in such a way that it has a heading, a horizontal rule, three links & also write three HTML documents for the links.

i)
```
<html>
    <head> </head>
    <body bgcolor = "turquise" ><font colour = "blue">
    <center><b> PROFILE </b> </center> < hH/>
     <p> <a href = "personal details.html" > PERSONAL DETAILS</a>
     </p>
     <p> <a href = "table.html"> EDUCATION QUALIFICATION </a>
     </p>
     <p><a href = "skills.html"> SKILLS < /a> </p>
     </body>
</html>
```

i) _____ is the heart of the warehouse.

I. Data mining database servers.

II. Data warehouse database servers.

III. Data mart database servers.

IV. Relational data base servers.

j) _____ is the specialized data warehouse database.

I. Oracle.

II. DBZ.

III. Informix.

IV. Redbrick.

k) _____defines the structure of the data held in operational databases and used by operational applications.

I. User-level metadata.

II. Data warehouse metadata

III. Operational metadata.

IV. Data mining metadata.

l) _____ is held in the catalog of the warehouse database system.

I. Application level metadata.

II. Algorithmic level metadata.

III. Departmental level metadata.

IV. Core warehouse metadata.

m) _____maps the core warehouse metadata to business concepts, familiar and useful to end users.

ii) When you click on Personal Details, the output will be

```
<html>
    <head> </head>
    <body bgcolour="turquise">
        <center><b><i> PERSONAL DETAILS </i><b> </center>
        <hr/>
        <pre><b>                Name : Panda
                Father&#146;s Name : Panda
                Mother&#146;s Name : Panda
                ADDRESS : Chengdu Research Base
                          of Gaint Panda
                Contact Number : *****
                E_mail : panda@sleeping.com
            </b>
        </pre>
    </body>
</html>
```

I. Application level metadata.

II. User level metadata.

III. Enduser level metadata.

IV. Core level metadata.

n) _____consists of formal definitions, such as a COBOL layout or a database schema.

I. Classical metadata.

II. Transformation metadata

III. Historical metadata.

IV. Structural metadata.

o) _____databases are owned by particular departments or business groups. A. Informational.

I. Operational.

II. Both informational and operational.

III. Flat.

IV. Informational.

2. Parts B : Short Response (Answer any 5 from the following questions. Each carrying 2 mark).

a) What is metadata?

b) Write the applications of data warehousing.

c) What is supervised learning?

d) what is activation function?

e) What is data redundancy and how to detect the redundancy in data warehousing?

f) Write down the different types of normalization Techniques.

3. Parts C : (Attempt any 2) Long Answer Type questions carrying 5 mark each.

a) Write down the differences between ROLAP, MOLAP and HOLAP.
b) Explain Artificial neural network with algorithm.
c) Explain K-means algorithm with example.

Output:-

i)

PROFILE

PERSONAL DETAILS
EDUCATIONAL QUALIFICATION/
SKILLS

ii)

PERSONAL DETAILS

NAME: Panda
FATHER'S NAME: Panda
MOTHER'S NAME: Panda
ADDRESS: Chengdu Research Base of Gaint Panda
CONTACT NUMBER: ****** ****
E-mail: panda@sleeping.com

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

Big Data & Cloud Computing & SOE-M-CSE105(3)

MTech. (CSE)-1st Semester TIME: 02 Hrs.

MAX MARKS: 30

Note: Answer in your own words

Part A:

Attempt any ten (10*2=20)

1. What is Data Analytics?
2. What are the five major characteristics of Big Data?
3. What is cloud computing?
4. How does HADOOP work with unstructured data?
5. In which pair form of data is stored in HDFS.
6. What is Big Data virtualization?
7. What is MR code in HADOOP?
8. Why is NoSQL important in Big Data Analysis?
9. What are the limitations of Hadoop?
10. How does missing data help us to find new information?
11. Write command to start Hadoop.
12. What are the different modes to open HADOOP?

Part B:

Attempt any two (2*5=10)

1. What is the need of reducing the dimension of Data?
2. How large data files are replicated in Hadoop cluster?
3. Compare between Cloud Computing, Edge computing.
4. What is PCA? How it is calculated?

O P JINDAL UNIVERSITY, RAIGARH (C.G.)
MID SEMESTER EXAMINATION, DECEMBER – 2021
ADVANCED NUMERICAL METHODS AND SCIENTIFIC COMPUTING(SOE-M-PEP101)
M. Tech. – I[st] Semester TIME : **02 Hrs**
EE MAX MARKS : **30**

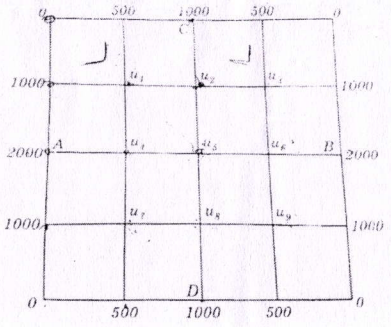
*Note : Part 1 is compulsory. Attempt any **four** questions from part 3.*

Part – 1[2 marks each]

1. Write finite difference approximations to partial derivative.
2. Evaluate $\Delta \cos 2x$.
3. Define algebraic and transdental equation with example.
4. Define Gauss- Jordan method.
5. Find the rank of the given matrix $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$

PART-2(5 marks each)

1. Find a real root of equation $x \log_{10} x = 1.2$ by Regula-Falsi method correct to four decimal places.
2. Derive the diagonal 5-point formula.
3. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following mesh with boundary values as shown in figure below



4. Solve the following equations by Gauss Jordan method

$$2x - 3y + z = -1\ ,$$
$$x + 4y + 5z = 25\ ,$$
$$3x - 4y + z = 2\ .$$

5. Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1, 0 < y < 1$ given that $u(0, y) = 0, u(x, 0) = 0, u(1, y) = 100, u(x, 1) = 100$ and $h = 1/3$.

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

POWER ELECTRONIC DEVICES AND CIRCUITS & SOE-M-PEP102

M.Tech. (EE)-1st Semester

TIME: 02 Hrs.
MAX MARKS: 30

Note: Q1 and Q2 are compulsory. Solve any 2 questions from Q3.

Q1. (a) Solid state contactor/relays for home appliances are _____devices. [10]

(b) Thyristor is nothing but a _____ switch.

(c) IGBT is having _____input impedance like MOSFET

(d) A modern power semiconductor device that combines the characteristics of BJT and MOSFET is _____

(e) Power-electronic converter circuits have a tendency to generate _____ in the supply system.

(f) The name 'Thyristor' has been derived by a combination of the capital letters from _____ _____ and _____.

(g) The voltage and current rating of 2P4M is _____ and _____

(h) The function of freewheeling diode in rectifier is _____.

(i) The input resistance of MOSFET is _____.

(j) IGBT is a _____ controlled device.

Q2. (a)Write merits, demerits and applications of thyristor. [10]

(b) Explain thyristor gate characteristics.

(c) Write features of IGBT.

(d) Define firing angle, extinction angle and conduction angle.

(e) Write the advantages of using free-wheeling diode

Q3. (a) A single phase transformer, with secondary voltage 230V, 50Hz delivers power to load R=10Ω through a half wave controlled rectifier circuit. For a firing angle delay of 60°, determine: (i) Form factor (ii) Ripple factor (iii) circuit turn-off time.

(b) Describe the different modes of operation of thyristor with its static V-I characteristics? [10]

(c) Write down the working principle of IGBT?

(d) Explain the working principle of half wave rectifier with suitable circuit diagram and waveform.

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

Advanced Power System Analysis & SOE-M-PEP103

M.Tech. (EE)-1st Semester TIME : **02 Hrs**

[Power Electronics & Power System] MAX MARKS : **30**

(Answer any three including question number 1)

Q1 **Answer all** **5×2 = 10**

a What is the need of base value?

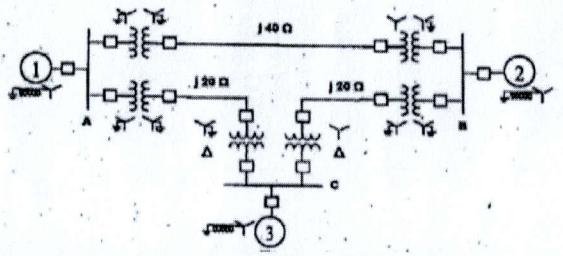
b Define various sequence components

c A star connected generator rated at 300 MVA, 33 kV has a reactance of 1.24 p.u. Find the ohmic value of the reactance

d Write the equation for per unit impedance if change of base occurs

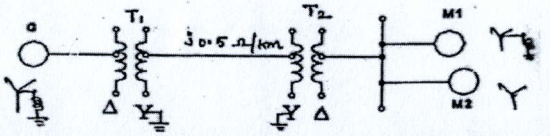
e Draw the zero sequence network of Star/Delta transformer with neutral ungrounded

Q2 Draw the impedance diagram of the following power system **10**



Mark impedances are in per unit. Neglect the resistance and use a base of 50 MVA, 138 kV in the 40 Ω line. The rating of the generators, motors, and transformers are:
Generator-1: 20 MVA, 18 kV, X'' = 20%
Generator-2: 20 MVA, 18 kV, X'' = 20%
Motor-3: 30 MVA, 13.8 kV, X'' = 20%
Three phase star-star transformers: 20 MVA, 138/20 kV, Y-Y, X=10%
Three phase star-star transformers: 15 MVA, 138/13.8 kV, Y-Δ, X=10%

Q3 **10**



300 MVA, 20 kV, three phase generator has sub-transient reactance of 20%. The generator supplies 2 synchronous motors through a 64 km transmission line having transformers at both the ends as shown in above Fig. In this T1 is a three phase transformer 350 MVA, 20/230 kV, 10% reactance and T2 is made of 3 single phase transformer of rating 100 MVA, 127/13.2, 10% reactance. Series reactance of the transmission line is 0.5 Ω/km. The ratings of 2 motors are: M1= 200 MVA, 13.2 kV, 20% and M2= 100 MVA, 13.2 kV, 20%. Draw the reactance diagram with all the reactances marked in p.u. Select the generator rating as base values.

Q4 *a* A generator with grounded neutral has sequence impedances of Z1, Z2 and Z0 and generator emf E. If a line to line fault occurs on the terminal of between phases 'b' and 'c', derive expressions for fault current and construct interconnection of sequence networks. **5**

b Deduce and draw sequence network for LLG fault **5**

Q5 A 25 MVA 13.2 kV, alternator with solidly grounded neutral has sub transient reactance of 0.25 pu. The negative and zero sequence reactances are 0.35 and 0.1 pu respectively. A single line to ground fault occurs at the terminals of an unloaded alternator. Determine the fault current and line to line voltage. **10**

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

HVDC Power Transmission [SOE-M-PEP105]

M.Tech. (Electrical)-1st Semester

TIME : **02 Hrs**

MAX MARKS : **30**

Section A

Section A (Attempt Any five Question) **2x5=10**

1. What are the demerits of HVDC transmission system?
2. What is importance of HVDC converter station
3. Mention the various sources of harmonic generation in HVDC system
4. Discuss the various sources of reactive power for HVDC converters
5. why commutation failure usually occurs in Rectifier?
6. Compare the HVDC transmission HVAC transmission with reference to following factors: i. Economics ii. Technical performance iii. Reliability
7. Why are harmonics generated in HVDC converter and what are the problems associated with the harmonics ?

Section B

Section A (Attempt Any five Question) **10x2=20**

1. Explain the major components of HVDC transmission in converter station unit?
2. Draw the schematic diagram of a typical HVDC link showing the major equipment at either ends.
3. Draw the schematic circuit diagram of a 6 pulse gratez circuit and explain its principle of operation.

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

OPJU
UNIVERSITY OF STEEL TECHNOLOGY AND MANAGEMENT

MID SEMESTER EXAMINATION, DECEMBER - 2021

ADVANCED POWER PLANT ENGINEERING & SOE-M-PPE101

M.Tech. (Mechanical)-1st Semester TIME: **02 Hrs.**

[POWER PLANT ENGINEERING AND ENERGY MANAGEMENT] MAX MARKS: **30**

Note: Write all questions of one part at one place

Part – A: Short Questions – 2 Mark each [2x10=20 Marks]

1. Define Energy resources and write the classification.
2. Classify the power plants based on conventional and non-conventional power plants.
3. Write the name of 4 thermal power plants in India with its state.
4. What are the four major circuits in thermal power plant?
5. Draw the T-s diagram of Rankine cycle and name the processes.
6. Define hydrology and write what information it provides?
7. Classify the hydroelectric power plants.
8. Write the advantages of hydroelectric power plants.
9. What do you mean by prime mover? Write the classification based on action of water.
10. Write the name of 4 hydroelectric power plants in India with its state.

Part – B: Descriptive Questions – 5 Mark each [5x2=10 Marks] answer any 2 out of 4

11. Give the layout of a modern steam power plant and explain it briefly
12. A Rankine cycle operates between pressures of 80 bar and 0.1 bar. The maximum cycle temperature is 600°C. If the steam turbine and condensate pump efficiencies are 0.9 and 0.8 respectively, calculate the specific work and thermal efficiency. Relevant steam table extract is given below

p(bar)	*t(°C)*	*Specific volume (m^3/kg)*		*Specific enthalpy (kJ/kg)*			*Specific entropy (kJ/kg K)*		
		v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
0.1	*45.84*	*0.0010103*	*14.68*	*191.9*	*2392.3*	*2584.2*	*0.6488*	*7.5006*	*8.1494*
80	*295.1*	*0.001385*	*0.0235*	*1317*	*1440.5*	*2757.5*	*3.2073*	*2.5351*	*5.7424*

80 bar, 600°C	v	$0.486\ m^3/kg$
Superheat	h	$3642\ kJ/kg$
table	s	$7.0206\ kJ/kgK$

13. Explain the Hydroelectric power plant with the help of neat sketch. Explain the each element of the plant in brief.
14. Draw the schematic diagram of pumped storage power plant and write principle of working.

O P JINDAL UNIVERSITY, RAIGARH (C.G.)
MID SEMESTER EXAMINATION, DECEMBER - 2021
ADVANCED NUMERICAL METHODS AND SCIENTIFIC COMPUTING(SOE-M-PPE102)

M. Tech. – I[st] Semester
MECHANICAL

TIME : **02 Hrs**
MAX MARKS : **30**

***Note** : Part 1 is compulsory. Attempt any **four** questions from part 2.*

Part – 1[2 marks each]

1. Write a short note on diagonal 5-point formula.
2. Write forward difference table, if

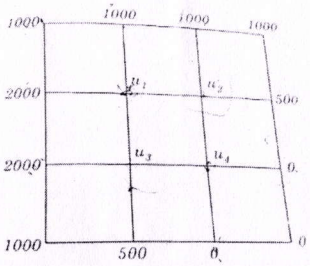
x:	10	20	30	40
y:	1.1	2.0	4.4	7.9

3. Write a short note on forward, backward and central difference.
4. Define Gauss Elimination Method.
5. What is the classification of $f_{xx} + 2f_{xy} + f_{yy} = 0$.

PART 2(5 marks each)

1. Using the bisection method, find a real root of the following equations correct to three decimal places: $x \log_{10} x = 1.2$ lying between 2 and 3

2. Write nth iterative for Jacobi's method and Solve the Laplace equation $u_{xx} + u_{yy} = 0$ in the domain given in figure(below) by Jacobi's method.



3. Solve the following equations by Gauss Elimination method, using pivoting Technique

$$2x + y + z = 10,$$
$$3x + 2y + 3z = 18,$$
$$x + 4y + 9z = 16.$$

4. Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1, 0 < y < 1$
given that $u(0, y) = 0, u(x, 0) = 0, u(1, y) = 100, u(x, 1) = 100$ and $h = 1/3$.
5. Find a root of an equation $f(x) = 3x + \sin x - e^x$, in the range using interval regula falsi method.

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OPJU
UNIVERSITY OF STEEL TECHNOLOGY AND MANAGEMENT

MID SEMESTER EXAMINATION, DECEMBER- 2021

Power Plant Machines [SOE-M-PPE 103]

MTech. (Mechanical)-1st Semester TIME:**02Hrs**

[Power Plant Engineering & Energy Management] MAX MARKS:**30**

Part – A: Solve all the Questions **(1x10=10 Marks)**

1) List the various losses in centrifugal pump?
2) What is NPSH of a pump?
3) What is Positive displacement pump?
4) Why is the Centrifugal Pump called High Discharge pump?
5) What is the principle of transformer action?
6) Why the efficiency of transformer is very high?
7) What should be the property of good quality core material?
8) What is the role of transformer oil? Write any two.
9) Can a transformer work on dc? If not, why?
10) What current flows in the transformer primary when secondary is open?

Part – B: Solve any 5 out of 7 **(2x5=10 Marks)**

1. Which are the three methods normally followed if the flow from a centrifugal pump is to be reduced?
2. What do mean by the term 'cavitation'? What are the undesirable effects of cavitation in a pumping system?
3. Change in impeller diameter of a pump affects the performance of the pump. Explain?
4. Why is the rating of transformer mentioned in KVA and not in KW?
5. What is efficiency of a transformer? Derive the condition of maximum efficiency.
6. What are different losses of transformer? Explain.
7. A two winding transformer has full load iron loss of 350 Watts and copper loss of 400 Watts. What will be the total losses of transformer at half of the full load?

Part – C: Solve any 2 out of 3 **(5x2=10 Marks)**

1. A centrifugal pump discharges 0.15 m^3/s of water against a head of 12.5 m, the speed of the impeller being 600 rpm. The outer and inner diameters of impeller are 500 mm and 250 mm respectively and the vanes are bent back at 35^0 to the tangent at exit. If the area of flow remains 0.07 m^2 from inlet to outlet, calculate:
   (i) Manometric efficiency of pump,
   (ii) Vane angle at inlet, and
   (iii) Loss of head at inlet to impeller when the discharge is reduced by 40% without changing the speed.
2. Derive EMF equation of a transformer. What are the assumptions taken for deriving it? What is transformation ratio?
3. Explain open circuit and short circuit test of transformer. How can we find different circuit parameters of transformer with the help of these tests?

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

Design and Analysis of Thermal Power Plant Equipments

SOE-M-PPE105(1)

M. Tech. – ISemester TIME : **02Hrs**
MECHANICAL MAX.MARKS:**30**

Note : HMT Databookis permitted.

Q1 a) In the case of a heat exchanger, the value of LMTD should be small or larger, or constant. (1)
b) Define the effectiveness of the heat exchanger. (1)
c) Define turbomachines? (1)
d) Why baffles are utilized in shell & tube heat exchangers. (1)
e) What are direct contact heat exchangers? (1)

Q2 a) Give classification of turbo-machines. (2)
b) What is fouling resistance in the heat exchangers? (2)
c) A counter flow shell & tube heat exchanger is used to heat water with hot exhaust gases. The water flows at the rate of 2 kg/s and the exhaust gases (cp=1000 j/kgK) flow at the rate of 5kg/s. If the heat transfer coefficient is 200W/m2K and the heat transfer area is 32m2. Find the NTU of the heat exchanger. (2)
d) Draw a 2-shell pass and 8 tube passes heat exchanger and what is the primary reason for using so many passes. (2)
e) What are the differences between parallel and counter flow heat exchangers? (2)

Q3a) A one shell pass, two tube pass HX has a total surface area of $5m^2$, and its overall heat transfer coefficient based on that area is found to be $1400W/m^2K$. If 4500 kg/h of water enters the shell side at 315^oC while 9000 kg/h of water enters the tube side at 40^oC, find the outlet temperatures using a) epsilon-NTU method. (5)

b) Hot and exhaust gases which enter the cross-flow heat exchangers at 300^oC and leave at 100^oC. It is used to heat pressurized water at a flow rate of 1 kg/s from 35^oC to 125^oC. The exhaust gas-specific heat is approximately 1000 J/kgK and the overall heat transfer coefficient can be assumed as 100 W/m^2K. Assuming that both the fluids are under unmixed conditions. Determine heat transfer area required for the heat exchanger using epsilon- NTU method. (5)

c) How the heat exchangers are classified and what do you mean by overall heat transfer coefficient. (5)

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MID SEMESTER EXAMINATION, DECEMBER - 2021

Advances in Material Science and Engineering (SOE-M-MST101)

M.Tech (Material Science and Technology)-1st Semester

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

Note: The Question paper consists of three parts A, B and C.
Part A consists of 4 questions of 2 marks each, you need to opt all these questions.
Part B consists of 5 questions of 5 marks each, you need to opt any 3 out of these 5 questions.
Part C consists of 4 questions of 9 marks each, you need to opt any 3 out of these 4 questions.

Part A

1) What is your understanding of material science and engineering, as well as how to classify materials-based properties and technologies?
2) How can the properties of a material be determined based on the right factors? Use examples to discuss it.
3) Simplify the classification of composite materials in a concise.
4) Discuss a crystal structure and give examples of materials that have crystal structure.

Part B

1) How are indices for a crystallographic direction in a cubic unit cell determined?
2) Calculate the atomic packing factors (APC) for BCC unit cell? Assuming atoms to be hard spheres.
3) Discuss crystalline and non-crystalline materials using appropriate examples.
4) Using engineering examples, discuss primary bonding and its categorization.
5) Iron at 2O ^{0}C is BCC with atomic radius of 0.124 nm. Calculates lattice constant a for a cube edge of iron unit cell.

Part C

1) Discuss the relationship between energy and separated distance for opposite charged ions.
2) How can the highest electrical and thermal conductors of metals be explained by electron gas model of metallic bonding?
3) Discuss recent advances in materials science and technology, as well as future prospects.
4) Determine the net force between a pair of Na+ and Cl- ions that have recently separated at equilibrium distance a_o

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

MID SEMESTER EXAMINATION – December 2021

PHYSICAL METALLURGY OF STEEL

(SOE-M-MST102)

M. Tech. - Semester-I
MATERIAL SCIENCE AND TECHNOLOGY

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

Note: Part 1 is compulsory and attempts any THREE questions from Part II and from Part III.

Part-I

4 X 2 = 8

Q1 a) Write two non-ferrous alloys you know having applications in aerospace industry.
b) Define Coordination number.
c) What is the relationship between grain size and yield strength?
d) What is eutectic reaction?

Part-II (ANY THREE)

3 X 5 = 15

Q2. a) Differentiate between crystalline and amorphous materials.
b) Define the following: Space Lattice, Bravais Lattice, Unit cell.
c) How is grain size measured? Please explain.
d) What is packing factor? Calculate the packing fraction in FCC.
e) Define Voids? How will be differentiate between tetrahedral and octahedral voids. Please mentioned how many number of these voids in FCC?
f) What do you mean by constitutional supercooling? Explain it.

Part-III (ANY THREE)

3 X 9 = 27

Q3. a) How many imperfections are there in crystals? Explain any two imperfections in detail.
b) Material can be strengthened by how many ways? Explain any two ways.
c) Define Solid Solution. What are the types of solid solution? What are the rules for the formation of solid solution.
d) Mention FIVE differences between Plastic Deformation by Slip and Plastic Deformation by Twin.
e) Write notes on heterogeneous nucleation.

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

THERMODYNAMICS AND KINETICS (SOE-M-MST103)

M.Tech. (METALLURGY)-1st Semester TIME: **02 Hrs**

[MATERIALS SCIENCE AND TECHNOLOGY] MAX MARKS: **50**

Note: The Question paper consists of three parts A, B and C.
Part A consists of 4 questions of 2 marks each, you need to opt all these questions.
Part B consists of 5 questions of 5 marks each, you need to opt any 3 out of these 5 questions.
Part C consists of 6 questions of 9 marks each, you need to opt any 3 out of these 6 questions.

Part A
(Attempt all)

Q.1. Write the first law of Thermodynamics in mathematical form. State the significance of the first law.

Q.2. What are open, closed and isolated systems? Give an example for each.

Q.3. What are extensive and intensive properties? Give an example for each.

Q.4. What is the equilibrium state? A system in thermodynamic equilibrium satisfies which three types of equilibrium?

Part B
(Attempt any 3)

Q.5. Derive the equation for work done by an ideal gas in a reversible isothermal process?

Q.6. Derive the equation $C_P - C_V = R$ for an ideal gas, where C_P and C_V are molar heat capacities at constant pressure and constant volume respectively, while R is the universal gas constant.

Q.7. The molar heat capacity at constant pressure for solid copper above 300 K is given by

$$C_P(Cu(s)) = 22.64 + 6.28 \times 10^{-3}T \quad \text{J mol}^{-1}\text{ K}^{-1}$$

By how much does the enthalpy of Cu increase on heating from 300 K to 800 K?

Q.8. Consider oxidation of tungsten carbide (WC) as follows:

$$WC(s) + 5/2\ O_2(g) = WO_3(s) + CO_2(g),\ \Delta H^0_{298} = -1195.8\ \text{kJ/mol}$$

Calculate the standard molar heat of formation, ΔH^0_f of WC from elements at 298 K by Hess's Law given that the standard molar heats of formation for WO_3 (s) and CO_2 (g) are -844.3 kJ/mol and -394.1 kJ/mol respectively.

Q.9. Illustrate with a diagram the working principle of a heat engine. How is efficiency defined for a heat engine? For a reversible Carnot cycle operating between source temperature (T_2) and sink temperature (T_1), state the equation for efficiency.

Part C

(Attempt any 3)

Q.10. Explain the concept of system and surroundings in thermodynamics with a diagram. How are thermodynamic systems classified (a) based on the number of components; (b) based on the number of phases; (c) based on reactiveness. What are isobaric, isochoric, isothermal and adiabatic processes?

Q.11. Derive the equation $PV^{\gamma} = constant$ for an ideal gas undergoing an adiabatic process. Using this expression, derive the equation for work done in an adiabatic expansion.

Q.12. An ideal gas at 300 K has a volume of 15 litres at a pressure of 15 atm. The constant volume molar heat capacity of the gas, C_V has the value of 1.5 R. For the two different cases where the gas undergoes (a) a reversible isothermal expansion to a pressure of 10 atm, and (b) a reversible adiabatic expansion to a pressure of 10 atm, calculate the following:

(i) The final volume of the system
(ii) The work done the system
(iii) The heat entering or leaving the system
(iv) The change in the internal energy
(v) The change in enthalpy

Q.13. Calculate the standard molar enthalpy of formation of titanium carbide, TiC (s) at 1200 K. Given the standard molar enthalpy of formation, ΔH_f^0 of TiC (s) at 298 K is -183,700 J, and the C_P values are:

$$C_P(C(s)) = 17.2 + 4.27 \times 10^{-3}T - 8.79 \times 10^{5}T^{-2} \text{ J mol}^{-1}\text{ K}^{-1} \text{ (validity 298 K – 2300 K)}$$

$$C_P(Ti(\alpha)) = 22.09 + 10.04 \times 10^{-3}T \text{ J mol}^{-1}\text{ K}^{-1} \text{ (validity 298 K – 1155 K)}$$

$$C_P(Ti(\beta)) = 28.91 \text{ J mol}^{-1}\text{ K}^{-1} \text{ (validity 1155 K – 1350 K)}$$

$$C_P(TiC(s)) = 49.5 + 3.35 \times 10^{-3}T + 14.98 \times 10^{5}T^{-2} \text{ J mol}^{-1}\text{ K}^{-1} \text{ (validity 298 K – 1800 K)}$$

Also, given the molar enthalpy of transformation of Ti ($\alpha \rightarrow \beta$) at 1155 K is 3473 J.

Q.14. Draw the Carnot cycle with an ideal gas as working substance in the form of a Pressure-Volume diagram, illustrating the different stages. Calculate the work done in each of the four stages, and the total work done in the Carnot cycle.

Q.15. The initial state of one mole of an ideal monoatomic gas is P = 10 atm and T = 300 K. Calculate the entropy change in the gas for (a) reversible isothermal decrease in the pressure to 1 atm; (b) reversible adiabatic decrease in pressure to 1 atm; and (c) reversible constant volume decrease in pressure to 1 atm. (Use C_V = 1.5 R if required)

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

MID SEMESTER EXAMINATION, DECEMBER - 2021

SUBJECT: POWDER MATERIALS AND PROCESSING

SUBJECT CODE: SOE-M-MST105 (3)

M.Tech. (METALLURGICAL ENGG.) -1st Semester

TIME: **02 Hrs.**

[MATERIAL SCIENCE AND TECHNOLOGY] MAX MARKS: **30**

NOTE: *Answer **ALL** questions from **Q1** and answer any **THREE** questions from **Q2**. and any **THREE** from **Q3**. Mark your answers with **VALID QUESTION NUMBER**.*

PART-I

Q1. **4 X 2 = 8**

a) State the limitations of powder metallurgy process.
b) Define specific surface area. Also state its dependable parameters.
c) Define the terms 'Microforging' and 'Agglomeration'.
d) "Low cooling rate is highly expected for atomization of particles"- Justify.

PART-II

Q2. **3 X 5 = 15**

a) State the matrices used for particle size. Illustrate with valid picture.
b) State the fundamental mechanism of atomization process.
c) How do you measure the 'Angle of Repose' for a given amount of metallic powder?
d) Provide one example where inert gas atomization process followed. What are the controlling parameters for such process?
e) Explain the design considerations for powder metallurgy process.

PART-III

Q3. **3 X 9 = 27**

a) How does the molten metal solidify into droplet? - Establish Conceptually.
b) "Heat treatment is generally carried out before mixing or blending" Explain the objectives behind such statement.
c) Sequentially state the steps used in a powder processing.
d) State the normal metal powder production methods. State elaborately.
e) Discuss experimental processes to measure the following terms:
   i) Powder Density.
   ii) Green Density.
   iii) Green Strength.