Course: B.Tech
Sub_Code: REE4C002/REL4C002

4th Semester Back Examination: 2024-25
SUBJECT: Electrical Machines-I
BRANCH(S): EEE, ELECTRICAL
Time: 3 Hours
Max Marks: 100
Q.Code: S431
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**

a) What is the function of the dummy coil in the DC machine?
b) What is the information obtained from the short-circuit test of a transformer?
c) Define Biot-Savart Law.
d) The full-load copper loss and iron loss of a transformer are 2000 W and 4000 W, respectively. The copper-loss and iron loss at half load will be, respectively?
e) What is the flux-linkage vs. current characteristic of magnetic circuits;
f) What will be current drawn by 220 V dc motors of armature resistance 0.5 ohm and back emf 200 V?
g) Define flux, reluctance, and inductance of the magnetic circuit.
h) What is the All-day efficiency of a transformer?
i) What is the difference between lap and wave winding?
j) A single-phase transformer when supplied from 200 V, 50 Hz has an eddy current loss of 50 W. If the transform is connected to a voltage of 300 V, 50Hz, the eddy current loss will be?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 x 8)**

a) Derive the torque equation of the DC Machine.
b) Explain with a phasor diagram of the Scott connection.
c) Explain the open circuit test of a single-phase transformer and find the constant loss.
d) Derive the emf equation of the DC generator.
e) Explain the flux-linkage vs. current characteristics of the magnetic circuit.
f) What do you mean by No-load and on-load tap-changing of transformers?
g) Explain the load Characteristics of the D.C Shunt Generator.
h) Explain the voltage built-up principle of the D.C. generator.
i) Draw and explain the torque-speed characteristics of separately excited, shunt and series motors.

j) A 6-pole lap wound D.C. shunt generator has 70 slots with 18 conductors per slot. The ratio of pole arc to pole pitch is 0.6. The diameter of the bore of the pole shoe is 0.35 m. The length of the pole shoe is 0.3 m. Calculate the speed at which it runs if the air gap flux density is 0.32 Wb/m^2 and the e.m.f. induced in the armature is 510 V.

k) The maximum efficiency of a 100 KVA, single-phase transformer is 98% and occurs at 80% of full load at 0.8 power factor lagging. If the leakage impedance of the transformer is 5%, find the voltage regulation at full load.

l) Explain the different Cooling methods used in the transformers.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16x2)**

Q3 What is the armature reaction of the DC machine? Explain the cross-magnetisation and demagnetisation effect.   **(16)**

Q4 Explain the commutation of the DC motor and draw the necessary diagram.   **(16)**

Q5 Draw the equivalent circuit diagram and phasor diagram of the single-phase transformer.   **(16)**

Q6 The 2000/200 V, 20 kVA transformer is connected as a step-up auto-transformer. The 200 V winding has enough insulation to withstand 2200 V to ground. Calculate: (i) The LV and HV side voltage ratings of the autotransformer, (ii) its kVA rating, (iii) kVA transferred inductively and conductively   **(16)**

4th Semester Regular Examination: 2024-25
SUBJECT: BASIC MANUFACTURING PROCESSES
BRANCH(S): MECH, MMEAM
Time: 3 Hours
Max Marks: 100
Q.Code: S577
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1	**Answer the following questions:**	**(2 x 10)**
a)	Name various pattern allowances in sand casting method.	
b)	Explain the term gating system.	
c)	Name any two binders used for bonding of core sand.	
d)	What are the functions of flux used in welding?	
e)	Write the difference between brazing and soldering.	
f)	List four methods of solid-state welding.	
g)	Name any four rolling defects.	
h)	What is meant by the formability of metals?	
i)	Distinguish between embossing and coining operation.	
j)	Why hot working is not recommended for sheet metal operations?	

Part-II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**
a)	What is pattern? What considerations are necessary when designing a pattern? With neat sketch explain various types of patterns.	
b)	Why testing of foundry sand is necessary? What are the common tests performed on foundry sands? Elaborately explain any two testing processes.	
c)	Sketch the cross section of a sand mould casting which is ready for pouring and briefly explain the various important parts. Briefly describe the necessary steps in sand casting operation.	
d)	Define welding and weldability. Classify the various welding processes with neat diagram.	
e)	Write the principle of oxy-acetylene gas welding. Describe with neat diagram the various flames obtained in oxy-acetylene gas welding process.	
f)	State the differences between TIG (GTAW) welding and MIG (GMAW) welding process.	
g)	Explain with neat sketch basic working principle of rolling process. Compare the different rolling mill arrangements in brief.	

h) What do you mean by metal forming process? State the difference between hot working and cold working process.

i) What are the basic two operations involved in forging? Explain in details different forging methods.

j) Draw the cross-section of a drawing die levelling various features in it. Also explain the different materials used for making wire drawing die. What is optimal die angle for wire drawing?

k) With neat sketch, discuss the basic principle of explosive forming.

l) Define surface engineering. Explain the importance of coating in modern manufacturing industries. Classify different coating methods.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   (16 x 2)

Q3 What is centrifugal casting? For what types of job would you recommend this casting process? With neat diagrams, explain the principle of working of true centrifugal casting process and semi-centrifugal casting process.   **(16)**

Q4 What is resistance welding? With neat sketch, explain the working principle of resistance welding. Discuss various resistance welding processes.   **(16)**

Q5 Explain the metal extrusion process. What are different types of extrusion processes? With neat sketch explain any three-extrusion process with their working principle, advantages, disadvantages, and application.   **(16)**

Q6 Define sheet metal working. Explain in detail the shearing process in sheet metal working. Explain the classification of sheet metal operations with suitable diagrams. Discuss in detail the types of dies used in sheet metal forming – simple, compound, progressive, and combination dies. Provide sketches where appropriate.   **(16)**

Registration No.:

Total Number of Pages: 02

Course: B.Tech
Sub_Code: PCAC2009

4th Semester Regular Examination: 2024-25
SUBJECT: Big Data Integration and Management
BRANCH(S): AEIE, BIOMED, CE, CIVIL, CSE, CSEAI, ECE, EEE, ELECTRICAL, ETC, MECH
Time: 3 Hours
Max Marks: 100
Q.Code: S270
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) What is the significance of ACID vs. BASE properties in big data systems?

b) What are the main challenges in modeling semi-structured data?

c) List two advantages of using columnar storage systems like HP Vertica.

d) Define the concept of "schema-on-read" and how it differs from "schema-on-write".

e) How does Impala handle real-time querying differently from Hadoop MapReduce?

f) Define the term "streaming data" and give one example.

g) What is meant by data integration in big data systems?

h) How does Spark handle parallel processing in ML pipelines?

i) What is overfitting in machine learning?

j) Define supervised and unsupervised learning with one example each.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) Compare and contrast the architecture and data modeling approach of Neo4j and AsterixDB.

b) Explain how SparkSQL facilitates real-time analytics and supports big data processing.

c) Describe the process of designing a big data information system using Redis and Impala.

d) Discuss the differences in data ingestion and storage mechanisms between traditional DBMS and big data systems.

e) Explain how HP Vertica can be used for high-speed analytics on large integrated datasets.

f) Discuss how you would process and integrate log files, JSON APIs, and user metadata using AsterixDB.

g) What are the major challenges of data quality in big data integration, and how can they be mitigated? Explain.

h) Compare and contrast batch and real-time processing models with suitable examples.

i) Describe the process of building an end-to-end ML pipeline in Spark for churn prediction.

j) How would you select features from a terabyte-scale dataset for a predictive model? Explain.

k) What are the key scalability challenges in ML with big data, and how can they be addressed? Explain.

l) Compare traditional machine learning tools with big data ML tools like Spark MLlib.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3   Describe a big data information system for a smart city project that integrates Neo4j for traffic routing and SparkSQL for pollution analysis.   **(16)**

Q4   Design an end-to-end big data pipeline that integrates social media data, web logs, and transactional data using SparkSQL and Redis.   **(16)**

Q5   Design a fraud detection system using Spark MLlib that can learn from both historical and streaming financial transaction data.   **(16)**

Q6   Explain a hybrid machine learning framework combining supervised and unsupervised learning for e-commerce customer segmentation.   **(16)**

4th Semester Regular Examination: 2024-25
SUBJECT: Computer Networks
BRANCH(S): CE, CSE, CSIT, CST, IT
Time: 3 Hours
Max Marks: 100
Q.Code: S580
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)
  a) Define ARPANET and its significance in networking.
  b) Differentiate between analog and digital signals.
  c) Name two collision-free protocols in the MAC sublayer.
  d) List any two transmission impairments and briefly describe them.
  e) What is a twisted pair cable? Mention its application.
  f) Explain the term CRC in error detection.
  g) What is meant by a simplex protocol?
  h) What is the significance of spanning tree bridges?
  i) Differentiate between a router and a switch.
  j) Define multiplexing and list its types.

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)
  a) Explain the OSI model layers and their responsibilities.
  b) Explain framing and error correction techniques in the data link layer.
  c) Describe the working of a stop-and-wait protocol with diagrams.
  d) Discuss the role of ICMP and IGMP in internetworking.
  e) Explain the ALOHA protocol and its variants.
  f) Discuss the different types of multiple access protocols.
  g) Compare IPv4 and IPv6 addressing schemes.
  h) Explain the framing techniques used in the data link layer.
  i) Explain the concept of congestion control in the network layer.
  j) What are the advantages of fiber optics over coaxial cables?
  k) Discuss the challenges in wireless LANs and their solutions.
  l) Explain various guided and unguided transmission media with diagrams.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3   Describe the architecture of the Internet, including logical addressing, IP, and   **(16)**
          supporting protocols (ARP, RARP, and DHCP).

Q4   Discuss all types of routing algorithms in the network layer. Compare their   **(16)**
          performance and applications.

Q5   An IP address is given as 192.168.10.14/28. Calculate: **(16)**
          - Network address
          - Broadcast address
          - Number of valid hosts
          - First and last valid host addresses.

Q6   A sliding window protocol is used with a window size of 7. If the sequence number   **(16)**
          field is 3 bits, is the protocol using Go-Back-N or Selective Repeat? Justify with
          calculations.

Registration No.:

4th Semester Regular Examination: 2024-25
SUBJECT: Computer Organization and Architecture
BRANCH(S): CE, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, IT
Time: 3 Hours
Max Marks: 100
Q.Code: S498
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) Represent (510) in binary signed magnitude and unsigned magnitude.

b) Evaluate $(-55)_{10} + (-54)_{10}$ and represent the result in binary.

c) Specify the location where the overflow bit is stored in an addition circuit.

d) State whether the control bus is unidirectional or bidirectional, and justify.

e) Explain how size and speed vary across different levels of memory hierarchy.

f) Describe the function of the instruction MOV A, M.

g) List the input signals required by a memory unit.

h) Define a block in the context of cache memory.

i) List the basic components of a microprocessor.

j) State the primary purpose of interrupts in a computer system.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) Differentiate between RISC and CISC architectures.

b) Explain different types of data transfer in DMA.

c) Define addressing mode. Explain five types with suitable examples.

d) Represent a space-time diagram for the execution of 12 instructions using a 4-stage pipeline.

e) Distinguish between a hardwired control unit and a microprogrammed control unit.

f) Explain the concept of cache coherence in multiprocessor systems.

g) Design adder and subtractor circuits using suitable registers.

h) Explain the concept of memory interleaving with suitable examples.

i) Draw a 4 × 6 memory structure showing address, data, and control buses.

j) Describe the basic components of a computer system based on the Von Neumann architecture.

k) Store the below 8085 instruction in a memory from 2400H onwards by showing its memory locations:
LXI H, 2300H
MVI A, 15H
MVI B, 16H
ADD B
HLT

l) Explain Flynn's classification of computer architectures.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 Demonstrate Booth's multiplication algorithm with a flowchart. Perform the multiplication of (+13) × (–11). **(16)**

Q4 Explain different types of circuitries in a I/O subsystem. Show the flow of information with a suitable diagram. **(16)**

Q5 Describe the instruction execution cycle using a state diagram. Apply the process to execute LXI H, 2300H **(16)**

Q6 Discuss the concept of virtual memory. Compute page faults using FIFO, LRU, and Optimal algorithms for the reference string 1 2 3 4 1 2 5 1 2 3 4 5 with 3 and 4 frames. **(16)**

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: CSPC2004

4th Semester Regular Examination: 2024-25
SUBJECT: Database Engineering
BRANCH(S): CE, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ELECTRICAL & C.E, IT
Time: 3 Hours
Max Marks: 100
Q.Code: S333
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1	Answer the following questions:	(2 x 10)

a) Which key is used to show the relationship between tables?
b) What is schema?
c) Define join.
d) What is meant by specialization and generalization?
e) What do you mean by canonical cover of a set of functional dependencies?
f) Define transaction.
g) What are different modes of Lock?
h) What do you mean by multivalued attribute? Write the notation used for the same.
i) List out anomalies of 1st Normal Form.
j) What do you mean by cardinality ratio?

Part-II

Q2	Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)	(6 x 8)

a) Draw and explain ER diagram that captures the information of the following schema.
Employee(empno, name, office, age)
Books(isbn, title, author, publisher)
Loan(empno, isbn, dat)

b) What is the difference between logical data independence and physical data independence?

c) Find the minimal cover for the following set of functional dependencies.

$A \rightarrow BC$
$AC \rightarrow D$
$D \rightarrow AB$
$AB \rightarrow D$

d) Discuss the ACID properties of a database transaction.

e) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $f = \{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}$. What is the key of R? Decompose R into 2NF and then 3NF relations.

f) Consider following 2 sets of functional dependencies.
F = {A→C, AC→D, E→AD, E→H} and
G = {A→CD, E→AH}
Check whether they are equivalent.

g) What are Armstrong Axioms? Use Armstrong Axioms to prove the soundness of decomposition rule and pseudo transitivity rule.

h) Consider the following set of FDs for a relation F = {A→BC, CD→E, E→C, D→AEH, ABH→BD, DH→BC}. Which of these FDs are redundant?

i) Consider the following 2 transitions.
T1: Read(A)
    Read(B)
    If A=0, then B=B+1
    Write(B)
T2: Read(B)
    Read(A)
    If B=0, then A=A+1
    Write(A)
Add Lock and Unlock instructions appropriately in transactions T1 and T2, so that they observe the 2 phase locking protocol. Can the execution of these transactions result in a deadlock?

j) Consider the relation scheme R(ABCDE) and the FDs {A→B, C→D, A→E}. Is the decomposition of R into (ABC), (BCD), (CDE) lossless?

k) What is serializability of transaction? Explain with example.

l) What is trigger? Explain different types of triggers.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3   Consider the following relational schema: **(16)**
DEPARTMENT (dept_no, dept_name, dept_location)
EMPLOYEE (emp_no, emp_name, job, designation, manager, hiredate, salary, dept_no)

    i)   Find out who earns the least.
    ii)   Which positions are paid higher than the average salary?
    iii)   Give the details of those departments that do not have any employee.
    iv)   Find the location of the employee named GADAA.
    v)   Show the details of those employees who have salaries equal to any employee of the department 30.

Q4   Find out all candidate keys for a relation R(ABCDEFGH) with the given FD's {A → C, B → D, G → H, E → F, C → G }.   **(16)**

Q5   Define the structure and properties of B+ Tree. Explain how the B+ tree is used as an index structure? Construct a B+ tree of order 4 with the following key values: 2, 3, 5, 7, 11, 17, 19, 23, 29, 31.   **(16)**

Q6   What do you mean by query optimization? Discuss in detail the various steps involved in query optimization.   **(16)**

Total Number of Pages: 02 **Course: IDD (B.Tech and M.Tech)**
Sub_Code: CSPC2006

4th Semester Regular Examination: 2024-25
SUBJECT: Design and Analysis of Algorithms
BRANCH(S): CE, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ELECTRICAL & C.E, IT
Time: 3 Hours
Max Marks: 100
Q.Code: S429
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1	**Answer the following questions:**	**(2 x 10)**
a)	Solve the recurrence: $T(n) = 2T(n/2) + n$ using Master Theorem.	
b)	Write the recurrence relation for binary search.	
c)	What is the best case time complexity of insertion sort?	
d)	When is merge sort preferred over quicksort?	
e)	What is the difference between Dijkstra's and Bellman-Ford algorithms?	
f)	Define the 0/1 Knapsack problem.	
g)	Differentiate between Greedy and Dynamic Programming approaches.	
h)	What is a state space tree?	
i)	Give an example where backtracking is not an efficient approach.	
j)	What is a reducibility in the context of NP problems?	

Part-II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**
a)	Explain and compare Big O, Θ, and Ω notations with suitable examples.	
b)	Analyze the time complexity of a recursive factorial function.	
c)	Explain AVL trees and their rotations with an example.	
d)	Describe disjoint set operations and their implementation using union by rank and path compression.	
e)	Describe the Matrix Chain Multiplication problem and its dynamic programming solution.	
f)	Explain Prim's and Kruskal's algorithms with example graphs.	
g)	Solve the Longest Common Subsequence problem using dynamic programming for two given strings.	
h)	Explain the Rabin-Karp algorithm with an example.	
i)	Describe the working of the Knuth-Morris-Pratt (KMP) algorithm.	
j)	Solve the 8-Queens problem using backtracking.	

k) Define NP-completeness and show that Subset Sum is NP-complete.

l) Describe the approximation algorithm for the vertex cover problem.

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Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

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Q3   Discuss in detail the concepts of P, NP, NP-complete, and NP-hard classes. Explain with suitable examples and diagrams. Include the significance of polynomial-time reductions.   **(16)**

Q4   Explain the implementation and complexity analysis of Red-Black Trees. Compare with AVL Trees.   **(16)**

Q5   Compare Greedy and Dynamic Programming approaches using the 0/1 Knapsack problem. Provide detailed pseudocode and complexity analysis.   **(16)**

Q6   Discuss various string matching algorithms (Naive, Rabin-Karp, Finite Automata, and KMP) and compare their time complexities.   **(16)**

4th Semester Regular Examination: 2024-25
SUBJECT: Design of Machine Elements-I
BRANCH(S): MANUTECH, MECH
Time: 3 Hours
Max Marks: 100
Q.Code: S501
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.
(Use of relevant data book is permissible)

Part-I

Q1	**Answer the following questions:**	**(2 x 10)**

a) What are fits and tolerances?

b) What is standardization?

c) What do you understand by the term riveted joint?

d) Where do you use a cotter joint? Give practical examples.

e) What are the various types of stresses developed in the key?

f) Distinguish clearly, giving examples between axle and shaft.

g) In a close coiled helical spring, the spring index is given by 'D/d', where, 'D' and 'd' are the mean coil diameter and wire diameter, respectively. For considering the effect of curvature, write the expression for Wahl's stress factor 'K'.

h) What is nipping in a leaf spring?

i) Name the commonly used materials for sliding contact bearings.

j) Define rating life of bearing.

Part-II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**

a) Briefly discuss about the factors to be considered for the selection of materials for the design of machine elements.

b) What do you understand by preferred numbers? Explain.

c) A steel plate, 100 mm wide and 10 mm thick, is welded to another steel plate by means of double parallel fillet welds as shown in Fig. 1. The plates are subjected to a static tensile force of 50 kN. Determine the required length of the welds if the permissible shear stress in the weld is 94 N/mm^2.
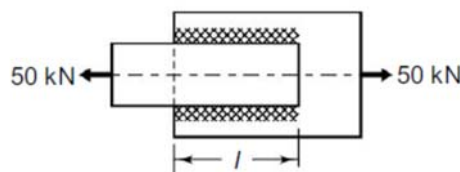

Fig. 1

d) Define the following terms use in screw threads:
(I) Major diameter, (II) Minor diameter, (III) Pitch, and (IV) Lead.

e) Sketch two views of a knuckle joint and write the equations showing the strength of joint for the most probable modes of failure.

f) How are the keys classified? Draw neat sketches of different types of keys and state their applications.

g) A hollow steel shaft transmits 600 kW at 500 r.p.m. The maximum shear stress is 62.4 MPa. Find the outside and inside diameter of the shaft, if the outer diameter is twice of inside diameter, assuming that the maximum torque is 20% greater than the mean torque.

h) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.

i) Describe, with the help of neat sketches, the types of various shaft couplings mentioning the uses of each type.

j) State and explain the importance of A.M. Wahl's factor in the design of helical springs.

k) What are the various terms used in journal bearings analysis and design? Give their definitions in brief.

l) Select appropriate type of rolling contact bearing under the following condition of loading giving reasons for your choice.
1. Light radial load with high rotational speed.
2. Heavy axial and radial load with shock.
3. Light load where radial space is very limited.
4. Axial thrust only with medium speed.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3   What are the steps involved in design of a machine element? Explain.   **(16)**

Q4   A double riveted lap joint with chain riveting is to be made for joining two plates 10 mm thick. The allowable stresses are: σ_t = 60 MPa; τ = 50 MPa and σ_c = 80 MPa. Find the rivet diameter, pitch of rivets, and distance between rows of rivets. Also, find the efficiency of the joint.   **(16)**

Q5   Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used:
Shear stress for shaft, bolt and key material = 40 MPa
Crushing stress for bolt and key = 80 MPa
Shear stress for cast iron = 8 MPa
Draw a neat sketch of the coupling.   **(16)**

Q6   Design a journal bearing for a centrifugal pump from the following data:
Load on the journal = 20000 N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55 °C = 0.017 kg / m-s; Ambient temperature of oil = 15.5 °C; Maximum bearing pressure for the pump = 1.5 N / mm². Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m²/°C.   **(16)**

Registration No.:

4th Semester Regular Examination: 2024-25
SUBJECT: ELECTRICAL MACHINES-II
BRANCH(S): EEE, ELECTRICAL, EE
Time: 3 Hours
Max Marks: 100
Q.Code: S338
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)

a) Derive the relation between electrical and mechanical angle in case of rotating machine.

b) An 8-pole synchronous generator is running at 750 rpm. What is the frequency? At what speed must the generator be run so that frequency shall be 25 Hz?

c) Name different methods of finding the voltage regulation of alternators. Which method gives more accurate results?

d) State the advantages of short pitched coils in armature of AC machines.

e) Describe the slip test method-for the measurement of X_d and X_q of synchronous machines.

f) A synchronous motor is operating at half full-load. An increase in its field current causes a decrease in its armature current. Before the change in field current, did the armature current lead or lag the terminal voltage? Justify your answer.

g) Why is the induction motor called asynchronous motor?

h) What does crawling of induction motor mean?

i) Discuss few differences between single phase and three phase induction motors.

j) Why single-phase induction motor has low power factor?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)

a) A 500 kVA, 1,100 V, 50 Hz star connected 3-phase alternator has armature resistance per phase of 0.1 Ω and synchronous reactance per phase of 1.5 Ω. Find its voltage for (I) 0.9 pf lag and (II) 0.8 pf lead. Also find the voltage regulation in each case and draw phasor diagram.

b) What is meant by "armature reaction" of a synchronous machine? What are the relations of armature reaction and power factor of a synchronous machine?

c) Derive the equation for power developed in a cylindrical rotor alternator.

d) A 3-phase, Y-connected syn. generator supplies current of 10 A having phase angle of 20° lagging at phase voltage of 400 V. Find the load angle and the components of armature current Id and Iq if Xsd = 10 ohm and Xsq = 6.5 ohm. Assume that Ra to be negligible. Also, calculate voltage regulation.

e) Explain the effect of increasing driving torque and speed of one of the alternators in a parallel connected two alternators.

f) Define synchronizing power? What is synchronizing power and synchronizing Torque Coefficient?

g) Justify, synchronous motor is not self-starting. Explain the method of starting of synchronous motor.

h) Draw the V-curve and inverted V-curve at different loading conditions.

i) What are the differences between synchronous motor and induction motor?

j) An 1100V, 50Hz delta-connected induction motor has a star-connected slip-ring rotor with a phase transformation ratio of 3.8. The rotor resistance and standstill leakage reactance are 0.012Ω/phase and 0.25Ω/phase respectively. Neglecting stator impedance and magnetizing current determine,
   I. The rotor current at start with slip-rings shorted.
   II. The rotor power factor at start with slip-rings shorted.
   III. The rotor current at 4% slip with slip-rings shorted.
   IV. The rotor power factor at 4% slip with slip-rings shorted.

k) With neat sketch explain different starters used for starting of 3-Phase Induction Motor.

l) Why are the single phase induction motor not self starting? Explain different methods of starting of the single phase induction motor.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 Derive the EMF equation of alternators. A three phase, 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency and the phase and line EMF. Assume the coil span as 150°. **(16)**

Q4 a) What are the conditions required for the parallel operation of alternator? What are the advantages of parallel operation of two alternators? **(8 + 8)**

b) Explain "Two bright and One dark lamp" method of synchronization of three phase alternator with infinite bus-bar.

Q5 a) Describe with a neat diagram, the principle of operation of induction generator. **(8 + 8)**

b) Develop the equivalent circuit of a poly phase induction motor. Explain how this equivalent circuit is similar to the transformer equivalent circuit?

Q6 State and explain the double field revolving theory of single phase induction motor with detailed diagram. Also draw torque-speed characteristic curve. **(16)**

Registration No.:

Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: EEPC2004

4th Semester Regular Examination: 2024-25
SUBJECT: Electrical Measurement & Instrumentation
BRANCH(S): EEE, ELECTRICAL
Time: 3 Hours
Max Marks: 100
Q.Code: S432
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) A 0 to 200 V voltmeter has a guaranteed accuracy of 1% of full-scale reading. The voltage measured by this instrument is 50 V. What is the limiting error?

b) What is the piezoresistive effect?

c) Explain the phenomena of Creeping and Errors in the energy meter.

d) Discuss different types of transducers.

e) In the two-wattmeter method of measuring 3-phase power, the power factor is 0.5, then one of the wattmeters will read?

f) What is the difference between reliability and resolution?

g) The current flowing in a circuit consists of a DC of 3A and an AC of peak value 2A. The readings of a moving coil ammeter and a moving iron ammeter will be.

h) Give the different stages inside the CRT tube.

i) An energy meter having a meter constant of 1200 rev per KWH is found to make five revolutions in 75 seconds. What is the load power?

j) Write down the main advantages of Wagner Earth devices used in A.C. bridge circuits.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) Write down the working principle of power factor meters.

b) Explain the different types of errors in measuring instruments

c) The exciting current of a ring core CT of ratio 1000/5 A. When operating at full primary current and with a secondary burden of noninductive resistance of 1 ohm is 1A at a p.f. of 0.4. (I) Calculate the phase displacement between the primary and secondary current. (II) The ratio error at full load, assuming that there has been no compensation.

d) Explain the characteristics of a Current Transformer.

e) Evaluate the unknown capacitance by using the Schering Bridge.

f) Draw the circuit diagram of the Maxwell-inductance Bridge. Draw the phase diagram of the Maxwell-inductance Bridge.

g) The inductive reactance of the pressure coil circuit of a dynamometer wattmeter is 0.4% of its resistance at normal frequency 50 Hz and the capacitance is negligible. Find the percentage error and correction factor due to the reactance for load at 0.707 p.f. lagging.

h) Write down the working principle of thermocouples.

i) A linear resistance potentiometer is 100 mm long and is uniformly wound with a wire of total resistance 10000 ohms. Under normal conditions, the slider is at the center of the potentiometer. Determine the linear displacement when the resistance of the potentiometer, as measured by the Wheatstone bridge, is 3700 ohms. If it possible to measure a minimum value of 5 ohms of resistance with the above arrangement, determine the resolution of the potentiometer in mm.

j) Derive the expression for the gauge factor of the strain gauges.

k) Write the function of the attenuator in CRO.

l) Describe the construction and working principle of a D'Arsonval galvanometer.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)　　　　　**(16 x 2)**

Q3 Explain the working of an electrodynamometer-type wattmeter. Derive the expression for torque when the instrument is used on AC.　　**(16)**

Q4 Derive the general torque equation for the Moving iron instrument.　　**(16)**
The inductance of a moving iron meter is given by the following expression: $L = 20 + 10\alpha - 2\alpha^2$ micro hennery, where α is deflection in radians. The spring constant is 24×10^{-6} Nm/rad. Calculate the value of deflection for a current of 5A.

Q5 Describe the construction and working principle of the Vibrating Reed Type and the electrical Resonance Type frequency meter.　　**(16)**

Q6 Draw the basic block diagram of an oscilloscope and state the function of each block. Describe the Oscilloscope specifications and performance.　　**(16)**

4th Semester Regular Examination: 2024-25
SUBJECT: Engineering Economics
BRANCH(S): AEIE, AUTO, BIOMED, CE, CIVIL, CSE, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ETC, MECH, METTA, MINERAL, MME
Time: 3 Hours
Max Marks: 100
Q.Code: S246
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1	**Answer the following questions:**	**(2 x 10)**
a)	Define Engineering Economics.	
b)	State the law of variable proportion.	
c)	What do you mean by Break-even Point?	
d)	Distinguish between nominal and effective interest rates.	
e)	Define Present Worth method in project evaluation.	
f)	What is meant by Straight Line Method of depreciation?	
g)	Mention any two functions of the Central Bank.	
h)	What is opportunity cost? Give an example.	
i)	State one difference between GDP and GNP.	
j)	Mention two causes of depreciation of a capital asset.	

Part-II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**
a)	Discuss the various types of elasticity of demand with examples.	
b)	Explain Law of Returns to Scale with appropriate diagrams.	
c)	Briefly explain cost-output relationship in the short run.	
d)	Discuss the concept of Internal Rate of Return (IRR) and how is it different from Net present values?	
e)	Explain the causes and types of inflation.	
f)	Evaluate the Future Worth of a project that gives ₹1,000 annually for 4 years at an interest rate of 8% compounded annually. Also, draw the cash flow diagram.	
g)	Explain the various functions of a central bank and how they contribute to financial stability.	

h) Discuss the relationship between price elasticity of demand and total expenditure.

i) What is the Law of Supply? Illustrate it using a supply schedule and diagram. Discuss possible exceptions to the law.

j) Differentiate between monopolistic competition and oligopoly with reference to product differentiation and market power.

k) Differentiate between microeconomics and macroeconomics. Explain with suitable examples how both branches are relevant to engineering economic decisions.

l) Annual Worth Method is often preferred for mutually exclusive projects with unequal lives. Justify this statement with a solved numerical example.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 XYZ and ABC are two mutually exclusive project. The cash flows are shown below. Calculate projects' NPV at 9% and IRR. Why these two methods rank projects differently? Show your calculations. **(16)**

Project	Year-0	Year-1	Year-2	Year-3
XYZ	−3360	2800	1400	280
ABC	−3360	280	1680	3020

Q4 What is National Income? Explain in detail the three methods of measuring national income. Discuss their merits and limitations. **(16)**

Q5 Explain the three stages of short run production function with a suitable example. Where a rational producer produces and why? **(16)**

Q6 "In a perfectly competitive market, no single firm can influence the market price, yet the market is perfectly efficient." Discuss this statement with reference to the assumptions and long-run implications of perfect competition. **(16)**

Total Number of Pages: 03

Course: B.Tech/ IDD
Sub_Code: CIPC2005

4th Semester Regular Examination: 2024-25
SUBJECT: Fluid Dynamics
BRANCH(S): CIVIL
Time: 3 Hours
Max Marks: 100
Q.Code: S504
Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Can you apply Bernoulli equation within a boundary layer for a steady incompressible flow? Write your comments.

b) Why does the boundary layer increase with distance from the upstream edge.

c) A jet of water having a velocity of 20 m/s strikes a series of plates fixed radially on a wheel revolving in the same direction of the jet at 15 m/s. What is the percentage efficiency of the plates?

d) A horizontal water jet with a velocity of 10 m/s and a cross-sectional area of 10 mm^2 strikes a flat plate held normal to the flow direction. Determine the total force on the plate.

e) What do you mean by friction and form drag?

f) With the delay in boundary layer separation, does the form drag increase or decrease for a bluff body?

g) Define the specific speed of a turbine. What is its significance?

h) Discuss the difference between an impulse and a reaction turbine.

i) Discuss why it is necessary to provide an air vessel in reciprocating pumps.

j) What do you mean by supercritical flow in an open channel?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Air is flowing over a smooth plate with a velocity of 10 m/s. The length of the plate is 1.2 m and the width is 0.8 m. If a laminar boundary layer exists up to a value of the Reynolds number of 2 x 10^5, find the maximum distance from the leading edge up to which the laminar boundary layer exists. Find the maximum thickness of the laminar boundary layer if the velocity profile is given by:

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

The kinematic viscosity of air is 0.15 stokes.

b) Air moves over a 10 m long flat plate. The transition from laminar to turbulent flow takes place between Reynolds numbers of 2.5×10^6 to 3.6×10^6. What are the minimum and maximum distances from the front edge of the plate along which one expects laminar flow in the boundary layer? The free stream velocity is 30 m/s and $\nu = 1.5 \times 10^{-6}\,\text{m}^2/\text{s}$.

c) A body of length 2 m has a projected area $1.5\,\text{m}^2$ normal to the direction of its motion. The body is moving through water, which is having viscosity of 0.01 poise. Find the drag on the body if it has a drag coefficient of 0.5 for a Reynold number of 8×10^6.

d) With a neat sketch, discuss the working of a centrifugal pump.

e) A jet of water having a velocity of 50 m/s strikes a curved vane, which is moving with a velocity of 30 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 90° to the direction of motion of the vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vane without shock.

f) The following data is related to a Pelton wheel:
Head at the base of the nozzle = 90 m,   Diameter of the jet = 120 mm,
Discharge of the nozzle   = $0.5\,\text{m}^3/\text{s}$,   Power at the shaft = 206 kW,
Power absorbed in mechanical resistance = 4.5 kW. Determine (I) power lost in nozzle and (II) power lost due to hydraulic resistance in the runner.

g) The external and internal diameters of an inward flow reaction turbines are 1.5 m and 0.6 m respectively. The head on the turbine is 25 m and velocity of flow through the runner is constant and equal to 3.0 m/s. The guide blade angle is given as 10° and the runner vanes are radial at inlet. If the discharge at outlet is radial, determine:
(I) speed of the turbine, (II) the vane angle at outlet of the runner, and (III) Hydraulic efficiency.

h) Draw the ideal indicator diagram for a reciprocating pump, explaining different processes/strokes. Discuss the effect of piston acceleration on the indicator diagram and the network output.

i) A centrifugal pump delivers water against a net head of 15 m and a design speed of 1000 rpm. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 350 mm and the outlet width is 50 mm. Determine the discharge of the pump if manometric efficiency is 96%.

j) A double acting reciprocating pump, running at 50 rpm, is discharging 1 m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200 mm. The delivery and suction head are 25 m and 6 m respectively. Find the slip of the pump and power required to drive the pump.

k) Water flows over a rectangular weir 1 m wide at a depth of 150 mm and afterwards passes through a triangular right-angled weir. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth over the triangular weir.

l) Find the discharge through a trapezoidal notch which is 1 m wide at the top and 0.4 m at the bottom and is 30 cm in high. The head of water on the notch is 20 cm. Assume C_d for rectangular portion is 0.62, while for triangular portion is 0.60.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 A single jet Pelton turbine is required to drive a generator to develop 10 MW. The available head at the nozzle is 762 m. Assuming electric generator efficiency 95 %, Pelton wheel efficiency 87 %, coefficient of velocity for nozzle 0.97, mean bucket reduces the relative velocity by 15 per cent, and find the following (a) the diameter of the jet, and (b) the rate of flow of water through the turbine (c) the force exerted by the jet on the buckets. **(16)**

Q4 A Francis turbine has a diameter of 1.4 m and rotates at 430 rpm. Water enters the runner without shock with a flow velocity of 7 m/s. The difference between the sum of the static and potential heads at the entrance to the runner and at the exit from the runner is 62 m. The turbine develops 12.25 MW. The flow rate through the turbine is 12 m^3/s for a net head of 115 m. **(16)**

Q5 An irrigation channel of trapezoidal section, having side slopes 3 horizontal to 2 vertical is to carry a flow of 10 cumec on a tangential slope of 1 in 5000. The channel is to be lined for which the value of the friction coefficient in Manning's formula is n = 0.012. Find the dimensions of the most economical section of the channel. **(16)**

Q6 An impeller with an eye radius of 51 mm and an outside diameter of 406 mm rotates at 900 rpm. The inlet and outlet blade angles are 15° and 7° respectively, while the depth of the blade is 64 mm. **(16)**
Assuming zero inlet whirl, zero slip, and hydraulic efficiency of 89%, calculate
  (a) The volume flow rate through the impeller,
  (b) The stagnation and static pressure rise across the impeller,
  (c) The power transferred to the fluid and
  (d) The input power to the impeller.

Total Number of Pages: 02   **Course: IDD (B.Tech and M.Tech)**
                                                               Sub_Code: MEPC2003

4th Semester Regular Examination: 2024-25
SUBJECT: Fluid Mechanics and Hydraulic Machines
BRANCH(S): MANUTECH, MECH, MMEAM
Time: 3 Hours
Max Marks: 100
Q.Code: S433
Answer Q1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   Answer the following questions: **(2 x 10)**

   a)   What is Kinematic viscosity?

   b)   U-tube contains liquid of unknown density. An oil density 815 kg/m^3 is poured into one arm of the tube until the oil column is 14.5 cm high. The oil-air interface is then 6.5 cm above the liquid level in the other arm of the U-tube. Find the density of the liquid.

   c)   Define the specific speed of the centrifugal pump.

   d)   What do you mean by manometric efficiency and mechanical efficiency of centrifugal pumps?

   e)   Define slip of reciprocating pump.

   f)   Differentiate between the N-S equation and Euler's equation.

   g)   What is flownet?

   h)   Differentiate between Eulerian and Lagrangian description of flow

   i)   At room temperature, the density of liquid water is 0.9976 g/cm^3. If the pressure produced by a column of mercury with a height of 760 mm is to be replicated by a column of water, will the height of the water column be greater than, less than, or equal to 760 mm?

   j)   A 9.52 cm diameter sphere with a mass of 158.3 g is neutrally buoyant in a liquid. What is the density of the liquid?

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 x 8)

   a)   Derive the capillary height in water, when a small diameter tube is inserted in a fluid medium.

   b)   A Pelton wheel has a mean bucket speed of 12 m/s and supplied with water at the rate of 0.7 m^3/s under head of 300 m. If the buckets deflect the jet through an angle of 160°, find the power developed and hydraulic efficiency of the turbine.

   c)   Obtain an expression for the work done per second by water on the runner of a Pelton wheel.

   d)   State the Newton's law of viscosity. Sketch the Newton's law relationship for Newtonian and Non-Newtonian fluids. Give examples for each fluid.

   e)   A cylinder of 150 mm radius rotates concentrically inside a fixed cylinder of 155 mm radius. Both cylinders are 300 mm long. Determine the viscosity of the liquid that fills the space between the cylinders if a torque 0.98 N-m is required to maintain an angular velocity of 60 r.p.m.

f) A centrifugal pump delivers 30 L water per second to a height of 18000 mm through a pipe of 90 m in length and 100 mm in diameter. Find the power required to drive the pump. The overall efficiency of the pump is 75%, Assume, f = 0.012.

g) Write a short note on draft tube. Derive the pressure change in draft tube.

h) Derive the differential form of the continuity equation in Cartesian coordinates.

i) Two velocity components are given in the following equations, find the third component such that it satisfies the continuity equation: $u = x^3 + y^2 + 2z^2$, $v = -x^2y - yz - xy$

j) A horizontal venturimeter with a discharge coefficient of 0.98 is being used to measure the flow rate of a liquid of density 1030 kg/m^3. The pipe diameter at entry to the venturi is 75 mm and The venturi throat has an area of 1000 mm^2. If the flow rate is 0.011 m^3/s. Determine the height difference recorded on a U-tube manometer connecting the throat to the upstream pipe. Take the relative density of mercury to be 13.6.

k) Write a short notes on stability of immersed and floating bodiees.

l) Drive the expression of metacentric height for a floating body.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3 What do undertand by potential function and stream function?   **(16)**
The velocity potential is given as $\Phi = x^2 - y^2$. Determine the stream function. Also calculate the value of the stream functions and the velocity at point (4, 5). Calculate the slope of the stream function. State, if the flow is rotational or irrotational.

Q4 Illustrate and derive the expressions of: **(16)**
  i. Unit discharge for a turbine.
  ii. Unit speed for a turbine.

Q5 Derive the Bernoulli's energy equation from Euler's motion equation. A horizontal pipe of 250 mm diameter is enlarged suddenly to 500 mm diameter. The flow rate is 0.4 m^3/s. the pressure in a smaller pipe before enlargement is 14.715 N/cm^2. Determine i) loss of head due to sudden enlargement ii) pressure in the larger diameter section. and iii) power loss due to enlargement   **(16)**

Q6 A centrifugal water pump has an impeller of outer diameter of 60 cm and inner diameters 20 cm. It is 2 cm wide at outlet and 5 cm wide at inlet. The blade angles at inlet and outlet are 20° and 10° respectively. The impeller rotates at 1800 rpm. Neglecting losses and vane thickness, determine   **(16)**
  (i)   the discharge foe shockless radial entry
  (ii)   the theoretical head
  (iii) the power required
  (iv) the pressure rise through impeller

4th Semester Regular Examination: 2024-25
SUBJECT: Geotechnical Engineering
BRANCH(S): C&EE, CIVIL, CE
Time: 3 Hours
Max Marks: 100
Q.Code: S436
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1		Answer the following questions:	(2 x 10)
	a)	Define Darcy's law and state its limitations.	
	b)	What is the significance of the Unified Soil Classification System (USCS)?	
	c)	Differentiate between total stress and effective stress in soils.	
	d)	List two methods for field compaction.	
	e)	List two methods to determine the coefficient of permeability in the laboratory.	
	f)	What is the purpose of an inverted filter in geotechnical engineering?	
	g)	How does capillary action influence soil behavior?	
	h)	What is quick sand condition?	
	i)	Name the three phases in a soil system.	
	j)	What is the role of Mohr's stress circle in shear strength analysis?	

Part-II

Q2		Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)	(6 x 8)
	a)	Explain the Indian Standard Soil Classification System (ISSCS) with examples.	
	b)	Derive the relationship between porosity, void ratio, and degree of saturation.	
	c)	Discuss the factors affecting permeability of stratified soil deposits.	
	d)	Describe the construction and applications of flow nets in seepage analysis.	
	e)	Compare standard Proctor and modified Proctor compaction tests.	
	f)	Explain the spring analogy for one-dimensional consolidation.	
	g)	Discuss the shear characteristics of cohesive soils versus cohesionless soils.	
	h)	How does the triaxial compression test determine shear strength parameters?	
	i)	Describe the unconfined compression test procedure and result interpretation.	
	j)	Derive Laplace's equation for two-dimensional seepage flow.	
	k)	Explain the process of mechanical stabilization of soils.	
	l)	Discuss the role of clay mineralogy in soil structure formation.	

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 Derive and discuss the equations involved in Terzaghi's one-dimensional consolidation theory and explain the consolidation process with graphs. **(16)**

Q4 A clay layer is 4 m thick and drained on one side. If the coefficient of consolidation is 0.001 cm²/sec, calculate the time required for 50% consolidation. Discuss how this is interpreted in field conditions. **(16)**

Q5 A soil sample is tested for compaction. Analyze the results of standard and modified Proctor tests, plot the graphs and discuss optimum moisture content and maximum dry density determination. **(16)**

Q6 A soil sample has the following properties: Natural water content = 22 %, Specific gravity = 2.65, Bulk density = 18.5 kN/m³. Calculate void ratio, porosity, degree of saturation, and dry density. **(16)**

4th Semester Regular Examination: 2024-25
SUBJECT: Kinematics and Dynamics of Machines
BRANCH(S): AUTO, MANUTECH, MECH, MMEAM
Time: 3 Hours
Max Marks: 100
Q.Code: S352
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) Explain Grubler's criterion for determining degree of freedom for mechanisms.

b) Define I) Module II) Addendum

c) What do you mean by the term turning moment diagram?

d) Explain the term train value. How is it related to velocity ratio?

e) Define the term coefficient of fluctuation of speed.

f) What is the difference between a governor and a flywheel?

g) State laws of static friction.

h) Define slip of the belt.

i) What are the different types of mechanical brakes?

j) Differentiate between static and dynamic balancing.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) Sketch and explain any one inversion of a double slider crank chain.

b) State and explain Aronhold-Kennedy theorem.

c) Derive an expression for the length of the arc of contact in a pair of meshed spur gears.

d) How the velocity ratio of epicyclic gear train is obtained by tabular method?

e) Draw the turning moment diagram for a four stroke cycle I.C engine.

f) Derive the following relations for the maximum fluctuation of energy (ΔE), $\Delta E = 2 \times E \times K_s$ Where K_s = Coefficient of fluctuation of speed E = K. E of flywheel corresponding to mean speed.

g) Derive an expression for the height of Watt governor and prove that the height of the governor is inversely proportional to the square of the speed of governor.

h) What is a screw jack? Show that for an ideal screw-jack, the efficiency is independent of the weight lifted.

i) Derive an expression for the length of crossed belt drive.

j) A number of masses (say four masses) are attached to a shaft which is rotating at an angular speed of ω rad/sec. If all the masses are in the same plane, then describe the analytical method of balancing these four masses by a single mass only.

k) What do you mean by controlling force and controlling force curve?

l) Find an expression for the braking torque for a single shoe brake when brake drum is rotating (I) clockwise (II) anticlockwise and Friction force is at a distance "b" above the fulcrum.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 An epicyclic gear consists of three gears A, B, and C as shown in the figure. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 p.m.. If the gear A is fixed, determine the speed of gears B and C. **(16)**
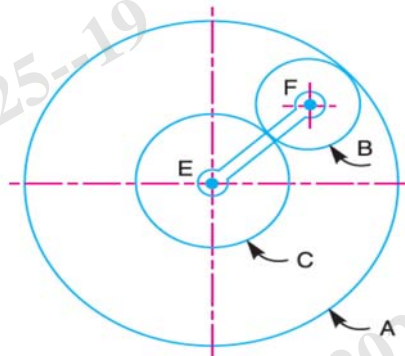
Q4 Prove that the ratio of tensions in the tight and slack sides of a band and block brake is given by **(16)**

$$\frac{T_n}{T_o} = \left(\frac{1 + \mu \, tan\theta}{1 - \mu \, tan\theta}\right)^n$$

Where θ = Half of the angle subtended by each block on the centre of the drum
T_n = Tension on tight side after n blocks, T_o = Tension on slack side

Q5 The turning moment diagram for a multi cylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = $3°$ horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end are as follows, + 52, − 124, + 92, − 140, + 85, − 72 and 107 mm^2, when the engine running at a speed of 600 rpm. If the total fluctuation of speed is not to exceed ± 1.5 % of the mean, find the necessary mass of the flywheel of radius 0.5 m. **(16)**
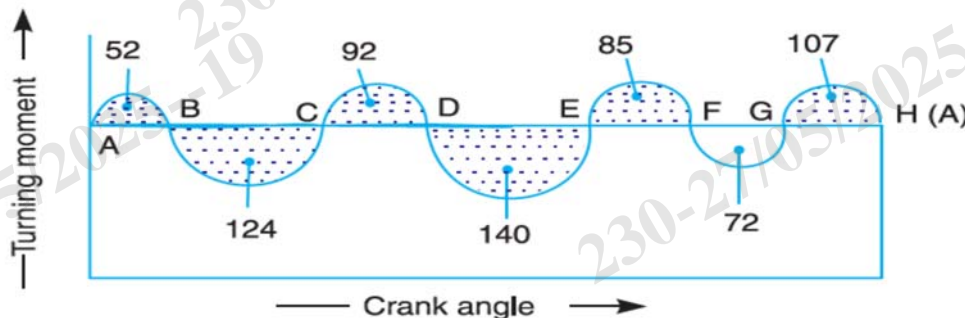
Q6 a) Derive an expression for magnitude and direction of Coriolis component of acceleration. **(10)**

b) Four masses m1, m2, m3, and m4 are 200 kg, 300 kg, 240 kg, and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m, and 0.3 m respectively and the angles between successive masses are 45°, 75°, and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. **(6)**

Registration No.:

4th Semester Regular Examination: 2024-25
SUBJECT: Organizational Behaviour
BRANCH(S): AE, AEIE, AERO, AME, AUTO, BIOTECH, C&EE, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ETC, IT, MANUTECH, MECH, METTA, MINING, MME, MMEAM, PLASTIC, PT
Time: 3 Hours
Max Marks: 100
Q.Code: S252
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1	**Answer the following questions:**	**(2 x 10)**
a)	State the importance of Organizational Behaviour (OB).	
b)	What do you mean by emotional intelligence?	
c)	What is selective perception? Explain with an example.	
d)	What is the difference between motive and motivation?	
e)	What do you mean by group behaviour?	
f)	Define transformational leadership.	
g)	Differentiate between strong and weak organisational culture.	
h)	What do you mean by workplace spirituality?	
i)	What do you mean by personality?	
j)	What is job attitude?	

Part-II

Q2	**Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**	**(6 x 8)**
a)	Describe the evolution of OB in brief.	
b)	What are the components of attitude?	
c)	Outline the barriers to changing attitudes.	
d)	Discuss the factors that influence perception.	
e)	Explain the application of Maslow's Need Hierarchy theory on human behaviour.	
f)	What are the types of groups in an organisation?	
g)	What are the contemporary theories of leadership?	
h)	What are the forces that act as a stimulant to change?	
i)	How can an organisation create a positive organizational culture?	

j) Explain Kotter's Eight-step model of change.

k) What is the Equity theory of work motivation? Explain with an example.

l) How to overcome the resistance to change?

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3   Explain the importance, limitations, and theoretical frameworks of OB.   **(16)**

Q4   Define personality along with its importance. Explain the Big Five personality model and how it can be helpful for organisations.   **(16)**

Q5   Define leadership. Explain applications of situational leadership theories with suitable examples.   **(16)**

Q6   What do you mean by managing change? Explain its nature and methods of implementing organizational change.   **(16)**

Registration No.:

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: EEPC2005

4th Semester Regular Examination: 2025
SUBJECT: Power Electronics
BRANCH(S): EEE, ELECTRICAL, ELECTRICAL & C.E
Time: 3 Hours
Max Marks: 100
Q.Code: S517
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**

a) What are the merits of single-phase bridge converter over single phase mid-point converter circuit?

b) Why an anti-parallel diode is connected across each MOSFET in Inverter?

c) Define latching current and holding current of a thyristor.

d) Can you achieve zero-degree firing angle for a SCR? Justify.

e) Why pulse gate drive is used for SCR?

f) Describe the principle of dc chopper operation.

g) With neat sketch explain the protection Circuit of SCR.

h) Out of frequency and duty cycle control which one is better and why?

i) What is the importance of blanking time in an inverter?

j) In a three phase six pulse diode rectifier, find the average output voltage in terms of maximum value of line voltage.

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 x 8)**

a) Draw and explain the dynamic characteristics of SCR during ON and OFF.

b) In a dc chopper, the average load current is 30 Amps, chopping frequency is 250 Hz. Supply voltage is 110 volts. Calculate the ON and OFF periods of the chopper if the load resistance is 2 ohms.

c) Explain the advantages and disadvantages of ac drives.

d) A single-phase half bridge rectifier having a supply voltage of $V_m \sin(\omega t)$ has a purely resistive load R. Determine

   I.   efficiency

  II. the form factor

 III. the ripple factor

 IV. the transformer utilization factor

  V.   the peak inverse voltage of diode the crest factor of input current

e) Explain the necessity of Using the Snubber Circuit.

f) How is SCR protected against dv/dt and di/dt? Explain with relevant circuit diagram.

g) A single-phase-to-single-phase cycloconverter is supplying an inductive load comprising of a Resistance of 5Ω and an inductance of 40 mH from a 230 V, 50 Hz single-phase supply. It is Required to provide an output frequency which is 1/3 of the input frequency. The converters are Operated as semi converter such that $0 \le \alpha \le \pi$ and firing delay angle is 120°. Neglecting the Harmonic content of load voltage, determine: (I) rms value of output voltage. (II) rms current of each thyristor and (III) input power factor.

h) Describe the principle of phase control in single phase half wave ac voltage controller.

i) Describe the operation of basic series inverter.

j) A number of SCRs, each with rating of 2000V and 50A, are to be used in series-parallel combination in a circuit to handle 11KV and 400A. For a derating factor of 0.15, calculate the number of SCRs in series and parallel units. The maximum difference in their reverse recovery charge is 20 microcoulombs. Calculate (I) the value of dynamic equalizing capacitance and (II) the voltage across each of the slow thyristor in case one series connected SCR is fast.

k) Draw the output voltage waveform of 3-phase full bridge thyristor rectifier for a firing angle of 30° explaining the operation of the converter.

l) Describe the principle of buck chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3 A single-phase bridge inverter has a resistive load of R = 3.5Ω and dc input voltage is **(16)** 100V. Determine (a) the rms output voltage at the fundamental frequency (b) The output power (c) the average and peak currents of each transistor (d) the peak reverse blocking voltage of each transistor (e) THD (f) The DF (g) The HF and DF of the LOH

Q4 Explain the working principle of a four-quadrant chopper.   **(16)**

Q5 Write short notes on   **(8 x 2)**
  (i) Sinusoidal PWM
  (ii) First and second quadrant chopper converter.

Q6 Describe the basic principle of working of single phase to single phase step down **(16)** cycloconverter for both continuous and discontinuous conductions for a Bridge type cycloconverter.

4th Semester Regular Examination: 2024-25
SUBJECT: Robotics: Mobility & Design
BRANCH(S): CIVIL, CSE, CSEAIML, ECE, EEE, ELECTRICAL, MECH, METTA
Time: 3 Hours
Max Marks: 100
Q.Code: S289
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1	Answer the following questions:	(2 x 10)

  a) What is bioinspiration in robotics?
  b) How do animal movements inspire robot design?
  c) How does bioinspiration help robots move more efficiently?
  d) What are walking and legged robots?
  e) Why are legged robots good for rough terrain?
  f) Write two basic material properties relevant to robot design.
  g) What is a biped robot?
  h) Where are quadruped robots commonly used?
  i) What is robotic perception?
  j) How do robots avoid obstacles using perception?

Part-II

Q2	Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)	(6 x 8)

  a) Explain the key principles of bioinspiration and how they differ from biomimicry in robotic engineering.
  b) Explain why perception is important for robots?
  c) How does epi polar geometry contribute to motion estimation and map building in the context of visual SLAM (Simultaneous Localization and Mapping)?
  d) How is perception beneficial for robots in making decisions?
  e) What are the steps involved in the camera calibration process?
  f) How do bioinspired robots improve efficiency and adaptability compared to traditional robots?
  g) How do mechanical properties influence the selection of materials for robotic structural components?
  h) What are the key parameters involved in perspective projection, and how do they influence the accuracy of visual perception?

i) Explain different actuation technologies, and their respective advantages and disadvantages.

j) Explain the importance of focal length and Dolly zoom effect in robotics.

k) Compare the design and movement of R Hex and Jerboa robots. Explain their advantages and disadvantages.

l) How do vertical and horizontal hopping robots differ, and how does this affect their efficiency and stability?

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 Discuss how bioinspiration has influenced the design and functionality of modern robots. Provide examples of specific animals or biological systems that have inspired robotic mechanisms. **(16)**

Q4 Explain the importance of camera calibration in robotic perception. How it affects the accuracy of 3D environment reconstruction? **(16)**

Q5 Explain the significance of material density and weight in the design of mobile robots, especially those intended for legged robots. Discuss their importance in robot joints and moving parts. **(16)**

Q6 Discuss the key design challenges in developing vertical hoppers and horizontal hoppers, focusing on balance control, energy storage, and impact absorption. **(16)**

Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: EOPC2003

4th Semester Regular Examination: 2024-25
SUBJECT: Signals & Systems
BRANCH(S): EEE, ELECTRICAL, EE
Time: 3 Hours
Max Marks: 100
Q.Code: S607
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**
a) Differentiate between continuous and discrete time signal.
b) State the Dirichlet's condition for Fourier series.
c) How to determine the time reversal of a signal?
d) Explain the associative property of linear convolution.
e) What are causal LTI systems?
f) Distinguish between auto-correlation and cross-correlation.
g) Write the trigonometric form of Fourier series of a periodic signal.
h) What is sampling theorem?
i) State the time scaling property of continuous time Fourier series.
j) Find out the Fourier transform of a unit impulse function.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**
a) $y(n) = 3x(n) + 5$, is a LTI system or not, Justify?
b) What is an energy signal, power signal? Explain with examples.
c) State and prove the multiplication property of Continuous Time Fourier Transform.
d) Find the cross correlation of the sequence {–2, 6, 7, 1, 9} and {1, –2, 1}.
e) Find the linear convolution between the sequences {2, 1, –3} and {10, 8, 2}.
f) Discuss Unit step, rectangular, and unit ramp signals with their mathematical and graphical representation.
g) How Discrete-Time Systems are described by Differential equation?
h) Describe the properties of Continuous Time Fourier Series.
i) How can a signal be reconstructed from its samples?
j) Discuss the properties of auto correlation.
k) What is Discrete-Time processing of Continuous-Time signals?
l) Explain the aliasing effect in signal processing with neat diagram.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   **(16 x 2)**

Q3   Classify discrete time signals and systems in detail with examples.   **(16)**

Q4 **a)** Prove that for convolution of LTI system the distributive property holds.   **(8 + 8)**

   b) State the relationship between convolution and correlation and prove it.

Q5   **Find out the Fourier series of the following functions:**   **(16)**
      (i) $f(x) = e^x$ on the interval $[-\pi, \pi]$.
      (ii) $f(x) = x^3$ on the interval $[-\pi, \pi]$.

Q6   Explain the following properties of Fourier Transform with a suitable example: **(16)**
      (i) linearity (ii) frequency shifting (iii) time shifting (iv) Time Reversal (v) Frequency
      Differentiation (vi) Time Convolution (vii) Frequency Convolution (viii) Correlation

4th Semester Regular Examination: 2024-25
SUBJECT: Structural Analysis
BRANCH(S): C&EE, CIVIL, CE
Time: 3 Hours
Max Marks: 100
Q.Code: S372
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
**The figures in the right hand margin indicate marks.**

Part-I

Q1 **Answer the following questions:** (2 x 10)

a) A beam is fixed at one end and hinged at other end. Find the kinematic indeterminacy of the beam.

b) What will be the support condition of conjugate beam if the support is fixed in real beam?

c) Write about Castigliano's theorem.

d) State maximum normal stress theory.

e) Estimate the deflection at the free end of a cantilever of length L with uniformly distributed load "w" on entire span. Flexural rigidity EI is constant on entire span.

f) State the concept of potential energy.

g) Show the normal thrust, radial shear force of a three hinged arch with neat sketch.

h) What will be the maximum bending moment for a simply supported beam of length 10 m with uniformly distributed load of 2 kN/m passing over the entire length?

i) State the principle of virtual work.

j) Find the degree of static indeterminacy of the structure as shown below. A & E are fixed supports, B & D are internal hinges and C is roller support.
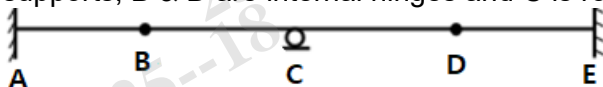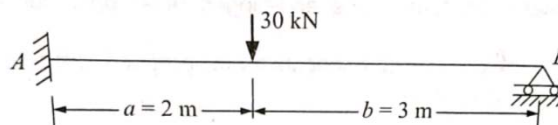

Part-II

**Q2** **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)

a) A beam of length 12 m fixed at both ends is subjected to uniformly distributed load 20 kN/m on entire span. Find the fixed end moments by moment area method. EI is constant throughout the length.

**b)** Determine the reaction components in support A and support B.

c) Determine the rotation at A and deflection at C in the overhanging beam as shown below by conjugate beam method.
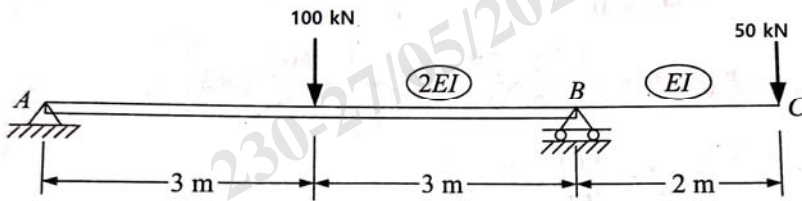
d) A simply supported beam of span "L" carries a concentrated load "P" at a distance "a" from the left hand support. Using Castigliano's theorem, determine the deflection under the load point.

e) Using strain energy method, determine the deflection at the free end of a cantilever of length 5 m subjected to uniformly distributed load 5 kN/m on entire span. EI is same on entire span.

f) Using unit load method, find the vertical deflection at E. Assume uniform flexural rigidity throughout.
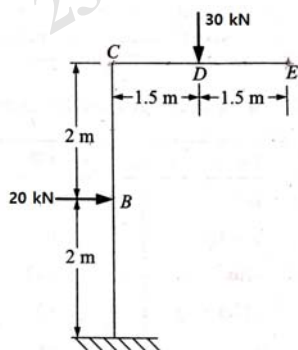
g) A three hinged parabolic arch of span 36 m and rise 6 m carries uniformly distributed load of 40 kN/m over the left half span and a concentrated load 100 kN at 30 m from left support. The bottom two hinges are in same level and third hinge is provided in the middle of arch. Analyze the arch and draw the bending moment diagram. Also find the normal thrust and bending moment at a section 10 m from the left support.

h) Using influence line diagram, determine the shear force and bending moment at section "C" in the simply supported beam as shown below.
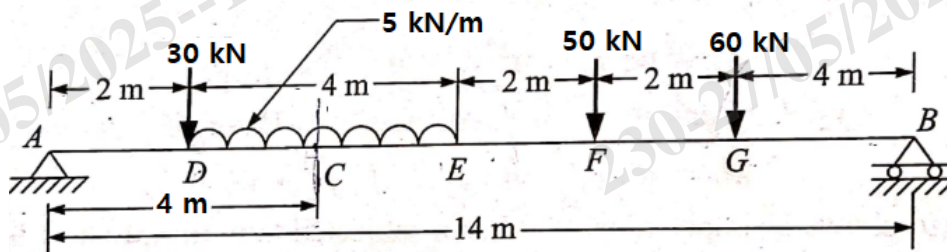
i) State and prove Maxwell's reciprocal theorem.

j) Draw the influence line diagram for reaction and bending moment at the fixed end of a cantilever of span "L".

k) A simply supported beam has a span of 20 m. Uniformly distributed load of 30 kN/m and 5 m long crosses the beam from left to right. Draw the influence line diagram for shear force and bending moment diagram at a distance 8 m from left end.

l) List out the differences between statically determinate and redundant (indeterminate) structures.
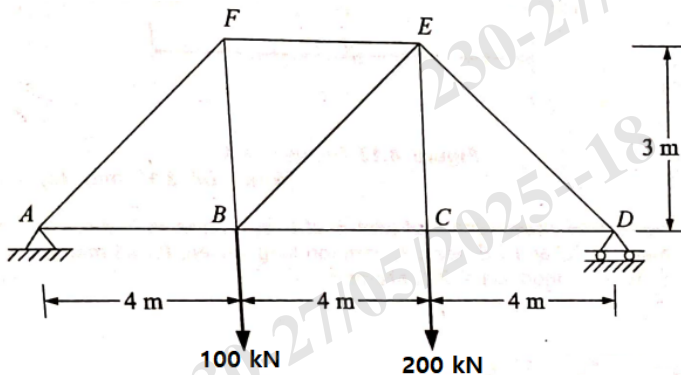
Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   (16 x 2)

Q3   Analyze the continuous beam as shown below and draw the bending moment diagram by   **(16)**
three moment equation.
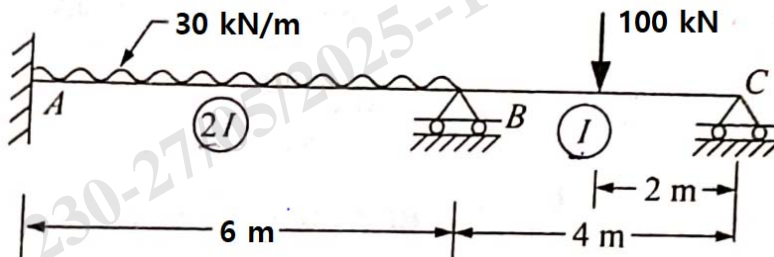
Q4   Determine the vertical deflection of joint F in the truss shown below. Cross sectional area   **(16)**
of all the members are 2500 mm². Take Young's modulus = 200 kN/mm².

Q5   The major principal stress on an element of a steel member is 200 N/mm² and tensile in   **(16)**
nature. The minor principal stress is compressive. If the tensile yield point of steel is 300
N/mm², find the minor principal stress at which the failure will occur according to following
theories of failure taking μ = 0.25
   I.   Maximum strain theory
   II.   Maximum strain energy theory
   III. Maximum shearing stress theory
   IV.   Maximum distortion energy theory

Q6   A suspension cable with 50 m span and 4 m dip is stiffened by a three hinged girder. The   **(16)**
dead load of the girder and the deck is 7.5 kN/m. Find S.F. and B.M. in the girder at a
section 10 m from left hinge when a concentrated load of 100 kN is placed at 8 m from the
left end. Find the maximum tension in the cable.

4th Semester Regular Examination: 2024-25
SUBJECT: Water Supply & Sanitary Engineering
BRANCH(S): CIVIL, CE
Time: 3 Hours
Max Marks: 100
Q.Code: S610
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Discuss the working principle of ion exchange process.

b) What are the advantage and disadvantage of dry intake tower over wet intake tower?

c) Describe methods for removal of iron and manganese from water.

d) Differentiate between coagulation and flocculation.

e) Discuss the factors, which affect the per capita demand of water in a community?

f) What are the functions of primary clarifier in waste water treatment plant?

g) The 5 day at 20°C BOD test result of a 100 times diluted waste water sample is as follows: Initial dissolved oxygen: 7.1 mg/L, Final dissolved oxygen: 2.3 mg/L. Find BOD_5?

h) Explain the bacterial growth curve with a neat sketch.

i) What are three R's of solid waste management?

j) Discuss the factors influencing solid waste generation rates.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Discuss two Physical, three chemical, and one biological water quality parameters and their significance

b) What is an intake? List the factors that govern the selection of a site for intake structure.

c) A pump is to deliver water from an underground tank against a static head of 62 m. The suction pipe is 85 m long and is of 40 cm diameter with Darcy-Weisbach friction factor f = 0.02. The delivery pipe is of 40 cm diameter, 2100 m long and f = 0.022. The pump characteristics may be expressed as $H_p = 100 - 6000Q^2$. Where H_p = pump head in meters and Q = discharge in m³/sec. Calculate the head and discharge of the pump.

d) What are the different methods of water softening? Describe Lime soda process of water softening in detail.

e) Discuss the different stages in sludge digestion process and factors affecting the process.

f) Differentiate between slow sand filter and rapid sand filter with reference to following parameters (a) rate of filtration (b) efficiency (c) size (d) method of cleaning (e) period of cleaning (f) effective size [d10] of sand

g) Design six slow sand filter beds from the following data:
- Population to be served = 50000 persons
- Quantity of water to be supplied = 200 litres per head per day
- Length of each bed is twice the breadth
- Rate of filtration: 150 litres/hr/m^2

Assume whatever data are necessary and not given.

h) A trickling filter has a diameter of 30 m and depth 3 m. It is operated with a direct circulation ratio of 1.5 and influent sewage rate of 2 million litres per day. Influent BOD into the filter is 200 mg/L and effluent BOD is 30 mg/L. Calculate the hydraulic loading rate and organic loading rate. What is the efficiency of the filter?

i) Discuss the working principles of following waste water treatment unit/process: (i) Skimming Tank (ii) Grit Chamber

j) Describe the various methods of sludge thickening.

k) Discuss on classification of Solid Waste based on (i) Source (ii) Types.

l) Explain and draw typical SWM system with its functional elements and linkages.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four) (16 x 2)

Q3 Define design period and population forecasting. What are the factors affecting the design period? A town has a population detail as given under. Estimate the future population in the year 2050 using Arithmetic Increase, Geometric Increase, incremental increase method and decreasing rate of growth method. **(16)**

Year	1950	1960	1970	1980	1990	2000	2010
Population (x10^3)	400	540	995	1550	1713	1893	2100

Q4 Discuss the working principles of any FOUR water treatment processes: (i) Sedimentation (ii) Electro-dialysis (iii) Defloridation (iv) Aeration (v) Disinfection **(16)**

Q5 What is meant by activated sludge process and trickling filter? Describe with neat sketch. Mention the advantage and disadvantage of these systems. **(16)**

Q6 Explain briefly the working principle, advantages, and disadvantages of biological treatment (aerobic and anaerobic composting) and thermal treatment (incineration) of municipal solid waste. **(16)**