

B.E. 5th Semester Examination, 2019-20**Subject : Data Base Management Systems****Paper : CSE-502****(Old)****Time: 3 Hours****Full Marks: 70***The figures in the margin indicate full marks.**Answer question No.1 and any four questions from the rest.**Instructions: Write all parts of a question together in one place.* $10 \times 1 = 10$ **1. Answer the following questions:**

- (a) What is DBMS?
- (b) Give an example of Data Definition Language (DDL).
- (c) What is database instance?
- (d) What is an entity set?
- (e) Define primary key.
- (f) Give an example of composite attribute.
- (g) Give an example of cardinality constraint for many to many relationship.
- (h) What is normalization?
- (i) Define a schedule.
- (j) What is a timestamp?

2. (a) Briefly explain the major advantages of a database system.**(b) What is data abstraction? Differentiate between three levels of data abstraction.****(c) Categorize different database-system users and explain their functions by the way they expect to interact with the system.** $5 + (2+3) + 5 = 15$ **3. (a) Differentiate between primary key, candidate key and superkey.****(b) What are the different types of mapping cardinalities? Explain them.****(c) Explain total and partial participation of an entity set with examples.****(d) What is the difference between specialization and generalization? Give examples.** $3 + 4 + 4 + 4 = 15$ **4. (a) Explain the difference between disjoint and overlapping design constraints.****(b) Consider the following information about votes taken in the U.S. House of Representatives during the current two years congressional session.****Please Turn Over**

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- (i) The database needs to keep track of each U.S. STATE'S Name (e.g., Texas, New York, California) and includes the Region of state (whose domain is {North-east, Mid-West, South-east, West}).
- (ii) To Each CONGRESSPERSON in the House of Representatives is described by their name, and includes the District represented, the Start Date when they were first elected, and the Political Party they belong to (whose domain is {Republican, Democrat, Independent, Other}).
- (iii) The database keeps track of each Bill (i.e., proposed law), includes the Bill Name, the DateOfVote on the bill, whether the bill PassedOrFailed (whose domain is {YES, NO}), and the Sponsor (the congressperson(s) who sponsored- i.e., proposed-the bill).
- (iv) The database keeps track of how each congressperson voted on each bill (domain of vote attribute is {Yes, No, Abstain, Absent}).

Draw an ER schema diagram for the above system. State clearly any assumptions you make.

5+10=15

5. (a) Define the following relational algebra operators with an example:

- (i) Cartesian product
- (ii) Set difference

- (b) Explain the principle of natural join operation with an example.

- (c) Differentiate between tuple and domain relational calculus with examples. 3+3+4+5=15

6. (a) Consider the following six relations for an order processing database application in a company:

CUSTOMER (Cust#, Cname, City)
 ORDER (Order#, Odate, Cust#, Ord_Amt)
 ORDER_ITEM (Order#, Item#, Qty)
 ITEM (Item#, Unit_Price)
 SHIPMENT (Order#, Warehouse#, Ship_Date)
 WAREHOUSE (Warehouse#, City)

Here, Ord_Amt refers to total dollar amount of an order; Odate is the date of order was placed; Ship_Date is the date of an order is shipped from the warehouse. Assume that an order can be shipped from several warehouses.

Specify the foreign keys for the above schema, stating any assumptions you make. Then specify the following queries in relational algebra:

- (i) List the Warehouse information from which the Customer 'J. Martin' was supplied his orders. Produce a listing: Order#, Warehouse#.
- (ii) Produce a listing: CUSTNAME, #OFORDERS, AVG_ORDER_AMT, where the middle column is the total number of orders by the customer and the last column is the average order amount for that customer.
- (iii) List the orders that were not shipped within 30 days of ordering.

- (b) Consider the following relations for a student database. Then specify the following queries in SQL:

STUDENT (Name, StudentNumber, Class, Major)

COURSE (CourseName, CourseNumber, CreditHouse, Department)

SECTION (SectionIdentifier, CourseNumber, Semester, Year, Instructor)

Grade_Report (StudentNumber, SectionIdentifier, Grade)

PREREQUISITE (CourseNumber, PrerequisiteNumber)

(i) Retrieve the names of all courses taught by Professor Smith in 2005 and 2006.

(ii) Retrieve the names and major departments of all students who do not have a grade of A in any of their courses. $(3+3+3)3+3=15$

7. (a) What is a functional dependency? Give example.

- (b) What is closure of a set of functional dependencies? Compute the closure of the following set F of functional dependencies for relation schema R=(A, B, C, D, E).

A->BC

CD->E

B->D

E->A

- (c) What is an extraneous attribute? How does an extraneous attribute 'A' can be identified in the functional dependency $\alpha \rightarrow \beta$ in F?

- (d) What is the lossless join property of decomposition? $2+(2+4)+(2+3)+2=15$

8. (a) Describe a procedure to test for dependency preservation. Suppose that, the relation schema R=(A, B, C, D, E) is decomposed into R1=(A, B, C) and R2=(A, D, E). Check whether the decomposition is dependency preserving or not if the following set of functional dependencies holds.

$$F=\{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$$

- (b) Describe the BCNF decomposition algorithm. Discuss why concurrency control is needed. $(4+6)+(3+2)=15$

9. (a) Describe the ACID property of a database transaction.

- (b) Define the following terms:

(i) cascadeless schedule

(ii) serializable schedule

- (c) What is the two phase locking protocol? Describe wait-die and wound-wait protocols for deadlock prevention. $3+(2+2)+(2+3+3)=15$



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B.E. 5th Semester Examination, 2022-23
Subject : Database Management Systems
Course Code : PCC-CSE-501

Time: 3 Hours**Full Marks: 70**

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer any five questions.

Write all parts of a question together in one place.

1. (a) Describe at least two tables that might be used to store information in a social-networking system.
 (b) What can be the potential reasons behind the overhead cost of using a DBMS over its traditional file processing counterpart? Suggest two scenarios when a Database System may not suffice the requirements or is undesirable.
 (c) Explain the difference between two-tier and three-tier architecture. With proper justification, suggest which sort of architecture is best suited for developing a web application. $4+4+6=14$
2. (a) Differentiate between the following terms:
 - (i) OODBMS and ERDBMS
 - (ii) Specialization and Generalization
 - (iii) Procedural DML and Non-procedural DML.
 (b) Assume we have the following application that models IPL cricket teams, the franchise they play for, and the players in each team. In the design, we want to capture the following:
 - We have a set of IPL franchise based teams, each team has an ID (unique identifier), team _ name, franchise _ name, captain, stadium and to which city the team belongs.
 - Each team has many players and each player belongs to only one team. Each player has an ID (unique identifier), name, DoB, start year, and jersey _ number that he uses.
 - Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
 - For each match we need to keep track of the following:
 - The data on which the game is played.
 - The final result of the match.
 - The players who participated in the match.

- For each player, how many runs he had scored, how many wickets he had taken, how many catches he had taken and how many boundaries he had scored?
- During the match, one player may substitute another player when retired. We want to capture this substitution and the match-over at which it took place.
- Each match has exactly three umpires: two on-field and one off-field. For each umpire we have an ID (unique identifier), name, DoB, years of experience.

Construct a concise ER diagram to capture the afore-mentioned requirements. State assumptions you have made that affect your design. Ensure that all cardinalities and primary keys are clearly depicted.

6+8=14

3. (a) Define the following terminologies in the context of Relational Algebra:

Project, Set Difference, Theta Join & Union Compatibility

- (b) Consider the following tables:

Customer (c_id, c_name, c_address)

Branch (br_name, br_city, assets)

Account (c_id, act_no, br_name, balance)

Give relational algebra query and domain calculus query to satisfy the following:

- (i) Customers who have accounts in all branches of 'Burdwan'.
- (ii) Customers who have accounts in branches with assets less than 10 lakhs.
- (c) Describe the six clauses in the syntax of an SQL query, stating which of them are mandatory and which ones are optional.

4+4+6=14

4. (a) What do you mean by the term functional dependency? Write a procedure for computing F^+ which is the closure of a set of functional dependencies.

- (b) Discuss the problems caused by spurious tuples and anomalies (insert, delete and update) and how we can prevent them.

- (c) Consider the following relation:

car_sale (car #, date_sold, salesman #, commission, discount)

Assume that a car may be sold by multiple salesmen and hence {car#, salesman#} is the primary key. Additional dependencies are:

data_sold \rightarrow discount and salesman# \rightarrow commission

Based on the primary key, identify whether the relation is in 1NF, 2NF or 3NF. Justify your answer. If possible, normalize the relation further.

5. (a) Define the following terms related to transaction:

4+4+6=14

Atomicity, Cascading Rollback, Conflict Equivalence and View Serializability.

- (b) Discuss how serializability is used to enforce concurrency control in a database system. Why is serializability sometimes too restrictive as a measure of correctness for schedules?

- (c) Consider schedules S1, S2 and S3 below. Determine whether each schedule is strict, cascadeless, recoverable or non-recoverable. Also determine the strictest recoverability condition that each schedule satisfies. 4+4+6=14

S1:R1(X); R2(Z); R1(Z); R3(X); R3(Y); W1(X); C1; W3 (Y); C3; R2(Y) ; W2(Z) ; W2(Y) ; C2 ;

S2:R1(X); R2(Z); R1(Z); R3(X); R3(Y); W1(X); W3(Y) ; R2(Y) ; W2(Z) ; W2(Y) ; C1; C2; C3;

S3:R1(X); R2(Z); R3(X); R1(Z); R2(Y); R3(Y); W1(X); C1 ; W2(Z); W3(Y); W2(Y); C3; C2;

6. (a) Discuss two multiversion concurrency techniques for concurrency control.
 (b) What are the advantages and disadvantages of using certify locks? What benefit does rigorous two-phase locking provide over its other two-phase locking counterparts?
 (c) Prove the following:
 (i) The wait-die and wound-wait protocols avoid deadlock and starvation.
 (ii) Strict two-phase locking guarantees strict schedules. 4+4+6=14

7. (a) Use Armstrong's axioms to prove the soundness of the following inference rules:
 (i) The Union Rule
 (ii) The Pseudotransitivity Rule
 (b) While designing a relational database, give proper justifications to address the following:
 (i) 3NF is more flexible, yet weak when compared to 3·5 NF.
 (ii) 4NF is more desirable than BCNF.
 (c) Suppose that we are using extendable hashing on a file that contains records with the following search-key values:

20, 30, 50, 70, 110, 170, 190, 230, 290, 310

Show the extendable hash structure for this file if the buckets can hold three records and the hash function is $h(x) = x \bmod 80$. Also state the effect on this hash structure when 'Delete 110' and 'Insert 10' operations are performed in order. 4+4+6=14

8. (a) Design a hash-based algorithm for computing the relational division operation.
 (b) When do we call two relational algebra expressions to be equivalent? Transform the given relational algebra expressions into its equivalent form by applying the necessary equivalence rules:

$$\Pi_{name}(\sigma_{city = "Burdwan"} \wedge salary < 22000 (branch \bowtie (account \bowtie depositor)))$$

 (c) Using a suitable illustration, explain the various steps involved in Query Processing.

4+4+6=14

9. (a) Discuss in details about the various types of discretionary privileges (both at the account level and the relation level) specified by a Data Base Administrator for enforcing the discretionary access control.
- (b) How can we revoke authorization in SQL? Give an example to showcase the limitations of SQL authorization.
- (c) In the context of distributed databases, discuss the pros and cons of Data Replication and Data Fragmentation.

4+4+6=14

10. (a) Explain the purpose of checkpoint mechanism. How often should checkpoints be performed?
- (b) Differentiate between the following:
- (i) No-steal Policy and Buffer Management Policy
 - (ii) System Crash and Disaster
- (c) In the context of database recovery techniques, explain log-based recovery and shadow paging schemes.

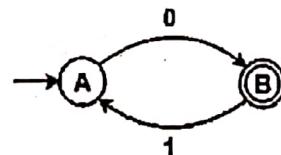
4+4+6=14



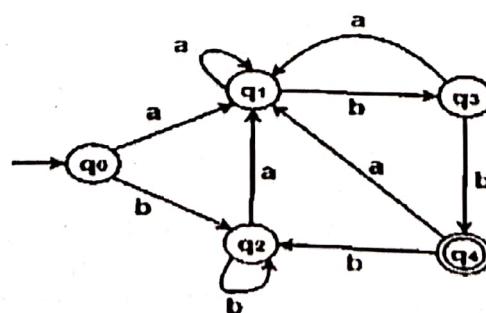
B.E. 5th Semester Examination, 2022-23
Subject : Formal Language and Automata Theory
Course : PCC-CSE-502

Time: 3 Hours**Full Marks: 70***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words
as far as practicable.**Attempt any five questions.*

1. (a) Suppose, $L(G) = \{a^m b^n | m > 0 \text{ and } n \geq 0\}$. Find out the grammar G which produces $L(G)$.
 (b) Explain Chomsky classification of grammars with proper examples.
 (c) Given $L = \{a^n b^{n+1} : n \geq 0\}$. Is it true that $L = L^*$ for the given language L ? 5+5+4=14
2. (a) Define the term 'Automata' with an example. What are the types of Automation? Explain Deterministic Automata with an example.
 (b) Design a DFA which accepts the language $L = \{w/w \text{ has both an even number of 0's and an even number of 1's over alphabet } \Sigma = \{0, 1\}\}$. (3+3+3)+5=14
3. Draw the NFA for the language $L = (a/b)^* abb$ and determine the equivalent DFA. 6+8=14
4. (a) Write the regular expression for the language containing the string over $\{0, 1\}$ in which there are at least two occurrences of 1's and between any two occurrences of 1's there are two occurrences of 0's.
 (b) Find regular expression for the following DFA using state elimination method: 4+10=14



5. (a) Minimize the following DFA using Equivalence Theorem:



- (b) Prove that $L = \{a^n b^n | n \geq 0\}$ is not regular.

10+4=14

6. (a) A CFG given by productions is

$$S \rightarrow a$$

$$S \rightarrow aAS$$

and $A \rightarrow bS$

Obtain the derivation tree of the word $w = abaabaa$.

- (b) Write a CFG which generate a set of palindromes over the alphabet $\Sigma = \{a, b\}$.

- (c) Find the equivalent CNF of the given grammar:

(5+5)+4=14

$$S \rightarrow aAbB$$

$$A \rightarrow aA|a$$

$$B \rightarrow bB|b$$

7. (a) Construct a PDA for the regular expression $r = 0^*1^+$.

- (b) Design a Turing machine that recognizes the set of all strings of 0's and 1's containing at least one 1.

7+7=14

8. Write short notes on (any two):

7+7=14

(i) Pushdown Automata

(ii) Transformation of NFA to DFA

(iii) Church-Turing Thesis



B.E. 5th Semester Examination, 2022-23**Subject : Object Oriented Programming****Course: PCC-CSE 503****Time: 3 Hours****Full Marks: 70***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words
as far as practicable.**Answer any five questions*

1. (a) What are objects? How they are created? Explain with example.
 (b) What do you mean by Constructor? Explain Parameterized Constructor.
 (c) Explain any one use of super keyword with a suitable example. $(2+3)+(2+3)+4$
2. (a) How do we add class or interfaces into a package?
 (b) What is a finally block? When and how it is used? Give a suitable example code.
 (c) What do you mean by method overloading? Explain with example. $3+(1+2+4)+4$
3. (a) Write a program to compute the sum of digits of an integer number.
 (b) Define an exception 'No match exception' that is thrown when a string is not equal to 'India'.
 Write a program that uses this exception.
 (c) What is multithreading? How it improves the performance? $5+5+4$
4. (a) What are command lines arguments? How they are useful? Show it using a Java program.
 (b) What is type casting? Why it is required in programming?
 (c) Explain the purpose of garbage collection in JVM? $(1+5)+4+4$
5. (a) What are FileInputStream and FileOutputStream?
 (b) What is synchronization and why is it important?
 (c) How to write parameterized class in Java using Generics? $4+4+6$
6. (a) What are the desirable properties of a design pattern?
 (b) Write a software requirement specification of an 'Examination Management System' and draw the corresponding class diagram(s), use case diagram(s) and sequence diagram(s). $4+10$
7. (a) Explain Singleton pattern.
 (b) Write a software requirement specification of a 'Student management system' and draw the corresponding class diagram(s), use case diagram(s) and sequence diagram(s). $4+10$

8. (a) Explain dynamic method dispatch.

(b) It is required to maintain and process the status of total 9 resources. The status value is to be stored in an integer array of dimension 3×3 . The valid status of a resource can be one of the followings:

Free: indicated by integer value 0

Occupied : Indicated by integer value 1

Inaccessible: indicated by integer value 2

Declare a class called ResourceStatus, having data member called statusRef, referring to a two dimensional array (3×3) of integers to be used to refer to the above mentioned status values. Define a member method called processStatusCount() that counts and displays total number of free resources, total number of occupied resources and total number of inaccessible resources. The exception to be raised and handled if total number of occupied resource exceeds total number of free resources. The handler marks status of all inaccessible resources as free. Accept initial status values from command line arguments and initialize the array. Raise and handle user defined exception if invalid staus value given.

Time: 3 Hours

The
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Group-A is co

1. Choose the correct ans

(i) For open control

- (a) Less exper
- (b) Recalibrati
- (c) Constructi
- (d) Errors are

(ii) The type 1 syste

- (a) no pole
- (b) net pole
- (c) simple pol
- (d) two poles

(iii) Which of the response?

- (a) Root locu
- (b) Bode plot
- (c) Nyquist p
- (d) None of th

(iv) With feedback

- (a) system



B.E. 5th Semester Examination, 2022-23**Subject : Signals and Systems****Course : ESC-EC-501****Time: 3 Hours****Full Marks: 70***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words
as far as practicable.**Answer any five questions from Q. 1. and any five from the rest.**Instructions : Answer all part of the questions under same Qn. No. in the same place.***1. Answer any five questions:** **$2 \times 5 = 10$**

- (a) Determine whether the signal $x(n)$ is an energy or a power of the discrete-time signal $x(n) = \left(\frac{1}{3}\right)^n u(n)$.
- (b) Determine whether the system $H[x(t)] = x^2(t)$ is BIBO stable or not.
- (c) $x_1(t) = \cos(2\pi t + \pi/4)$ and $x_2(t) = \cos(7\pi t)$. Check whether the composite signal $x_1(t) + x_2(t)$ is periodic or not. If so find the fundamental period.
- (d) Using the properties of Dirac Delta function evaluate: $\int_{-\infty}^{\infty} \sin(2\pi t) \delta\left(t - \frac{\pi}{4}\right) dt$.
- (e) What is the modulation property of Fourier transform?
- (f) Establish the condition of BIBO stability of an LTI system.
- (g) Find the auto-correlation of a discrete time signal $x(n) = \delta(n) + 2\delta(n-1) - 2\delta(n-2) - \delta(n-3)$.
- (h) Obtain the Z-transform of $x(n) = u(n)$.

2. (a) What is the difference between a stochastic and a deterministic signal?**(b) Sketch the signals :**

- (i) $x(t) = 2u(t+1)$
- (ii) $x_2(t) = r(t+1)$.

(c) Test the causality and time invariance of the following systems with $T[x(t)]$

- (i) $(t+1)e^{x(t-1)}$
- (ii) $t \cdot x(t)$.

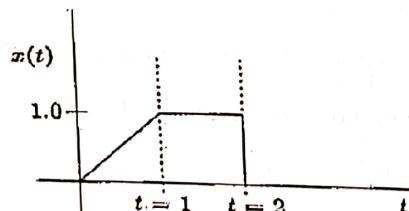
(d) Prove that : $\int_{-\infty}^{\infty} \delta(t) dt = 1$. **$2+(1+1)+(2+2)+4$** **3. (a) Find the expression for the signal shown in the diagram in Fig. 1.**

Fig. 1

- (b) Find the step response of the system whose impulse response is given by:

$$h(n) = \left(\frac{1}{2}\right)^n u(n) + \left(-\frac{1}{3}\right)^n u(n)$$

- (c) Test the linearity property of the system: $H[x(t)] = tx(t)$. 3+7+2

4. (a) State Paley Wiener's criterion.

- (b) Find the Fourier transform of $\exp(-at) u(t)$, and sketch its amplitude and phase spectra.

- (c) Using the approximation of the function obtain the Fourier transform of $x(t) = \text{sgn}(t)$, where

$$\text{sgn}(t) = 1, \text{ for } t > 0$$

$$0; t = 0$$

$$-1; t < 0$$

2+6+4

5. (a) For the continuous square wave signal $x(t)$ in Fig. 2 find the exponential Fourier series representation.

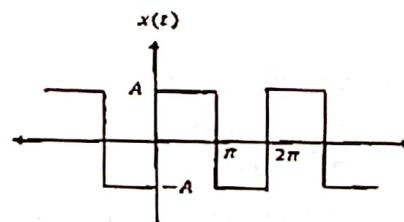


Fig. 2

10+2

- (b) Find the Fourier transform of $x(t) = \cos(\omega_0 t)$.

6. (a) Evaluate the convolution between $x(t) = u(t)$ and $h(t) = u(t)$.

- (b) Two systems with impulse responses $h_1(n)$ and $h_2(n)$ are interconnected as shown in Fig. 3. Obtain the output $y(n)$.

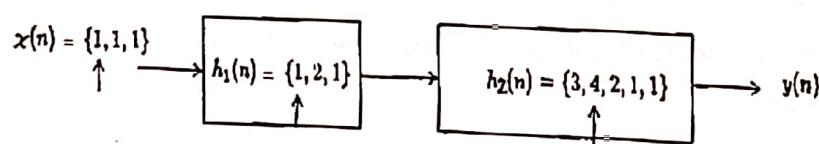


Fig. 3

5+7

7. (a) For a band-limited signal $g(t)$ with bandwidth ω_m , show that the sampling frequency ω_s should be at least $2 * \omega_m$.

- (b) Find the Nyquist sampling rate for $x(t) = 5 \cos(5000 \pi t) \cdot \cos(3000 \pi t)$ 10+2

8. (a) Determine the inverse Fourier transform of $X(\omega) = \frac{j\omega+1}{(j\omega)^2+5j\omega+6}$.

- (b) State Parseval's theorem.

- (c) State and prove the time scaling property of Fourier transform. 5+2+(1+4)

9. (a) Define cross-correlation of a discrete time signal.

- (b) Find the Z transform and the ROC of the system $x(n) = -\alpha^n u(-n-1)$.

- (c) Find the inverse Z-transform of $(z) = \frac{1}{(1-0.5z^{-1})(1-0.25z^{-1})}$. 2+5+5

B.E. 5th Semester Examination, 2022-23**Subject : Constitution of India****Course : MC-HU-501****Time : 3 Hours****Full Marks: 70***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words
as far as practicable.**Answers should be specific and to the point.**All parts of a question must be written together continuously.***Answer any five questions:** **$14 \times 5 = 70$**

1. (a) Explain the Directive Principles of State policy.
(b) Discuss briefly the different constitutional provisions for the welfare of SC, ST, OBC and women and their effects on their welfare. **$5+9=14$**
2. (a) Distinguish between Lok Sabha and Rajya Sabha.
(b) Describe the position and power of Prime Minister of India. **$5+9=14$**
3. (a) Explain the concept 'basic structure' of the Constitution of India.
(b) Identify and elaborate some areas in your professional life where you can use the knowledge gained from this subject. **$5+9=14$**
4. (a) Why is Preamble known as the key to the Constitution of India? Explain with reasons.
(b) Describe briefly the different ways by which the Constitution of India can be amended. **$5+9=14$**
5. (a) Explain the Panchayati Raj System of India.
(b) Describe the importance of grass-root democracy in the development of a democratic country like India. **$5+9=14$**
6. (a) Describe the different criteria for citizenship of India.
(b) Describe briefly the following case, its judicial decision and its impact on Indian Democracy:
Indra Nehru Gandhi Vs Sri Raj Naraian (1975) **$5+9=14$**
7. (a) Distinguish between judicial review and judicial activism.
(b) Briefly describe the election Law in India. **$5+9=14$**
8. (a) The Supreme Court of India is also called as 'A Court of Record'. —Discuss.
(b) Describe the Subordinate Courts in India and their functions. **$5+9=14$**