Time 90 min   M.M. 20

All questions are compulsory. Assume any missing data and mention it at the top of answer.

Ques 1   A university registrar's office maintains data about the following entities: 4 marks
    (a) **courses**: including number. title. credits, syllabus, and prerequisites,
    (b) **course offerings**: including course number, year, semester, section number, instructor(s),timings, and classroom,
    (c) **students**: including student-id, name, and program
    (d) **instructors**:, including identification number, name, department, and title.

Further, the enrolment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modelled. Construct an E-R diagram for the registrar's office.
Document all assumptions that you make about the mapping constraints.

Ques 2   Consider the relational database below, where primary keys are underlined. Give an   10 marks
expression in relational algebra to express each of the following queries:
Employee(<u>person-name</u>, street,city)
Works(<u>person-name</u>, company-name, salary)
Company(<u>company-name</u>, city)
Manages(<u>person-name</u>, manager-name)

    a)   Find names of all employees who live in the same city and same street as do their managers.
    b)   Give all managers in the database a 12% increase in salary.
    c)   Modify the database so that 'Adam' now lives in 'New Delhi'.
    d)   Find names, street address and cities of residence of all employees who work for "Indian Pvt ltd" and earn more than 20,000 per month.
    e)   Assume the companies may be located in several cities. Find all companies located in every city in which "Indian Pvt Ltd" is located.

Ques 3   Compute the closure of the following set of functional dependencies for relation schema   4+2 marks
$A = (P,Q,R,S,T)$.

$P \to QR$
$RS \to T$
$Q \to S$
$T \to P$
List the candidate keys for relation A?