E 1241 (Pages : 4) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2015

Third Semester

Complementary Course—OPERATIONS RESEARCH (QUEUING THEORY)

(For Model II B.Sc. Mathematics)

[2013 Admission onwards]

Time : Three Hours Maximum : 80 Marks

Part A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. What is a Zero sum game ?
2. Define pure and mixed strategics.
3. Define the term Pay-off matrix.
4. What is a Slack ?
5. Explain the term Total float.
6. Define the term Critical path.
7. Define the term Pessimistic time.
8. Name the essential features of Queuing System.
9. What is the probability density function $s(t)$ of service time T ?
10. State Markovian property of inter arrival times.

(10 × 1 = 10)

Part B

Answer any **eight** *questions.*
Each question carries 2 *marks.*

11. Define saddle point. Is it necessary that a game should always possess a saddle point.
12. State the major limitations of Game theory.
13. Explain the term CPM.
14. State the assumptions of PERT analysis.
15. Explain the basic logic of Arrow network.
16. What is Float ? What are the different types of Floats ?

Turn over

17. Explain the term Activity variance.

18. Explain the term Project variance.

19. Examine $\begin{bmatrix} 2 & 2 & 2 & 2 \\ 1 & 2 & 3 & 4 \end{bmatrix}$ for saddle point.

20. What is Traffic intensity ?

21. State the components of a Queue.

22. What do you understand by waiting system discipline ?

$(8 \times 2 = 16)$

Part C

Answer any **six** *questions.*
Each question carries 4 *marks.*

23. Solve graphically the game whose pay-off matrix is $\begin{bmatrix} 2 & 7 \\ 3 & 5 \\ 11 & 2 \end{bmatrix}$.

24. Solve the game with the pay-off matrix $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$.

25. State the circumstances where CPM is a better technique for project management than PERT.

26. An assembly is to be made from two parts X and Y. Both parts must be turned on a lathe and Y must be polished, where as X need not be polished. The sequence of activities together with their predecessors are given below :

Activity	*Description*	*Predecessor Activity*
A	Open work order	–
B	Get material for X	A
C	Get material for Y	A
D	Turn X on lathe	B
E	Turn Y on lathe	B,C
F	Polish Y	E
G	Assemble X and Y	D,F
H	Pack	G

Draw a network diagram for the project.

27. How does PERT technique help a business manager in decision-making.

28. What are the basic assumptions underlying the expected time estimate ?

29. Explain the constituents of a queuing model.

30. Define M/M/I Queue system.

31. Explain with suitable examples service time, queue length and busy period.

(6 × 4 = 24)

Part D

Answer any **two** *questions.*
Each question carries 15 *marks.*

32. (a) Use the notion of dominance to simplify the pay-off matrix and then solve the game :

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 4 & 2 & 0 & 2 & 1 \\ 4 & 3 & 1 & 3 & 2 \\ 4 & 3 & 4 & -1 & 2 \end{bmatrix}.$$

(b) Write both the primal and dual LP problems corresponding to the rectangular game with pay-off matrix :

$$\begin{bmatrix} 1 & -1 & 3 \\ 3 & 5 & -3 \\ 6 & 2 & -2 \end{bmatrix}.$$

33. For a small project of 12 activities the details are given below. Draw the network and find earliest occurrence time, latest occurrence time, critical activities and project completion time :

Activity	:	A	B	C	D	E	F	G	H	I	J	K	L
Dependence	:	–	–	–	B,C	A	C	E	E	D,F,H	E	I,J	G
Duration (Days)	:	9	4	7	8	7	5	10	8	6	9	10	2

34. A project is represented by the network shown below and has the following data :

Task	:	A	B	C	D	E	F	G	H	I
Optimistic time	:	5	18	26	16	15	6	7	7	3
Pessimistic time	:	10	22	40	20	25	12	12	9	5
Most likely time	:	8	20	33	18	20	9	10	8	4

Determine the following :

(a) Expected task times and their variance.

(b) The earliest and latest expected times to reach each event.

35. Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially with mean 3 minutes.

(a) What is the probability that a person arriving at the booth will have to wait ?

(b) The telephone department will install a second booth. When convinced that an arrival would expect waiting for atleast 3 minutes for a phone call. By how much should be the flow of arrivals increase in order to justify a second booth ?

$(2 \times 15 = 30)$