COURSE PLAN

Department :	Instrumentation & Control Engineering			
Course Name & code :	Real Time Operating System			ICE 4060
Semester & branch :	7th Sem	EIE		
Name of the faculty :	Sneha Nayak			
No of contact hours/week:	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

COURSE OUTCOMES (COS)

At the end of this course, the student should be able to:		**No. of Contact Hours**	**Marks**	**Program Outcomes (POs)**	**PSO**	**BL (Recommended)**
CO1	Articulate the characteristics of Real Time Systems	**5**	**15**	**PO1**	**2**	**2,3**
CO2	Interpret different types of Real Time Task Schedulers and analyze resource sharing in real time	**12**	**32**	**PO1,PO2 ,PO3**	**2**	**3,4**
CO3	Interpret features of a Real Time Operating System and various operating system services	**9**	**24**	**PO1**	**2**	**2,3**
CO4	Analyze Commercial Real Time Operating Systems	**5**	**15**	**PO1**	**2**	**2,3**
CO5	Analyze concepts and protocols of real time communication	**5**	**14**	**PO1,PO2**	**2**	**2,3**
Total		**36**	**100**			

*** COURSE LEARNING OUTCOMES (CLOS)

At the end of this course, the student should be able to:		**No. of Contact Hours**	**Marks**	**Program Outcomes (POs)**	**Learning Outcomes (LOs)**	**BL (Recommended)**
CO1						
CO2						
CO3						
CO4						
CO5						
Total						

***** Applicable to programs applied for IET accreditation only.**

Assessment Plan

S. No.	Assessment Mode	Assessment Method		Time Duration	Marks	Weightage	Typology of Questions (Recommended)	Schedule	**Topics Covered
1	**MISAC**	**1**	**Surprise Assignment**	**15 Mins**	**5**	1 Question × 5M = 5 marks (Minimum 5 questions to be given)	Bloom's taxonomy (BT) level of the question should be L3 and above.	August 28, 2023 – September 02, 2023	
		2	**Mid-term Examination**	**120 Mins**	**30**	**Objective:** 5M 10 MCQs × ½ = 5 marks **Descriptive:** 25M (3 Questions of each of 2 marks and 3 marks and 2 Questions of 5 marks)	Bloom's taxonomy (B) level of the question should be L3 and above.	September 25, 2023 – September 30, 2023	
		3	**Quiz**	**15 Mins**	**5**	10 MCQs × ½ = 5	Bloom's taxonomy (BT) level of the question should be L3 and above.	October 09, 2023 – October 14, 2023	
2	**FISAC**	**1**	**Take home assignment**	***	**10**	1 Question × 10M = 10 marks (Minimum 10 questions to be given)	Bloom's taxonomy (BT) level of the question should be L3 and above.	October 30, 2023 – November 06, 2023	
END – SEMESTER ASSESSMENT									
1	**Regular/Make–Up Exam**			180 Mins	50	Answer all 5 full questions of 10 marks each. Each question can have 3 parts of 2/3/4/5/6 marks.	Bloom's taxonomy (BT) level of the question should be L3 and above.	17th week of the semester	Comprehensive examination covering full syllabus.

***NOTE:** Information provided in the table is as per the In-semester assessment plan and schedule of V and VII semester B. Tech provided from Academic Section.*

Flexible In-semester Assessment Component (FISAC):

i) ONE f the components mentioned in Table 3 is to be selected by the faculty.

ii) The type of assessment should be informed to the students well in advance.

iii) Syllabus for the last component of In-semester Assessment (ISAC) i.e. FISAC should cover the topics mentioned for self-study if any / topics which are not covered till MISAC 3: Quiz.

Table 3: Flexible In-semester Assessment Component (FISAC)

No	Type	Description
A.	Quiz/MCQs	➢ Similar to MISAC 3: Quiz/MCQs ➢ Number of Questions:20 ➢ **Time duration:30 minutes**
B.	Surprise Assignment	➢ Similar to MISAC 1: Surprise assignment ➢ Bloom's taxonomy (BT) level of the question should be L3 ➢ Faculty have to set FIVE sets of Questions with each set having a minimum of TWO questions ➢ Each student will write the answers for ONE set of questions having a minimum of TWO questions. ➢ Question sets have to be distributed in such way that no two adjacent students would get the same set of questions. **Time Duration: 30 minutes**
C.	Take Home Assignment	➢ TEN questions will be given to each student. ➢ Questions must be at Blooms Taxonomy Level 3 or 4 ➢ Questions will be given to the students at least A MONTH in advance. ➢ Students have to write the answers to all the questions. ➢ Critical evaluation is to be done to differentiate.
D.	Group Assignment	➢ The students have to be grouped in such a way that there are 3 to 4 students in each group. ➢ Each group is to be given one question. ➢ The questions should be at Blooms Taxonomy Level 4 or 5 ➢ Questions are to be given well in advance (at least A MONTH ➢ before) ➢ The questions may be in the form of case studies, design, report writing, writing reflection article of their understanding on a journal paper given by the faculty to each group etc.
E.	Seminar	➢ Students are to be given the topics for seminar relevant to the course of study. ➢ Topics are to be given A MONTH in advance. ➢ Should be at Blooms Taxonomy Level 4 or 5 ➢ Topics should be related to the courses of study. ➢ Topics should be in the field of recent developments in the courses of study. ➢ Students have to collect the data regarding the seminar topic and submit a report. ➢ Students should make a presentation for about TEN minutes using Power Point.
F.	Quiz / Assignment based on invited talks	➢ Faculty have to arrange for the invited talk in the emerging areas in the courses of study. ➢ Quiz / Assignment is to be conducted on the topic of the invited talk. ➢ Questions should be at Blooms Taxonomy Level 4 or 5

G.	Development of Software / Apps	➢ Faculty has to define the problem statement. ➢ Problem Statements are to be given well in advance (at least A MONTH before the scheduled date of submission) ➢ Should be at Blooms Taxonomy Level 4 or 5. ➢ Students have to develop the software / mobile apps using the appropriate software language / platform and submit a report on the same. ➢ If it is a group activity, contribution of each individual student has to be assessed and evaluated.
H.	Mini Project	➢ Faculty has to define the problem statement. ➢ Problem Statements are to be given well in advance in advance (at least A MONTH before the due date for submission) ➢ Should be at Blooms Taxonomy Level 4 or 5 ➢ Students have to develop prototypes/models (physical/software based) ➢ A report covering all important aspects of the project has to be submitted by the students ➢ If it is a group activity, the contribution of each individual student has to be assessed and evaluated.

LESSON PLAN

L No	TOPICS	Course Outcome Addressed
1	Introduction to the course, Real time concept, applications of real time systems	CO1
2	Characteristics of real time systems	CO1
3	Safety and reliability	CO1
4	Types of real time tasks	CO1
5	Timing constraints	CO1
6	Task scheduling terminologies	CO2
7	Clock driven scheduling	CO2
8	Clock driven scheduling problems	CO2
9	Event driven scheduling	CO2
10	Event driven scheduling problems	CO2
11	Hybrid schedulers	CO2
12	Hybrid schedulers problems	CO2
13	Earliest deadline scheduling	CO2
14	Earliest deadline scheduling problems	CO2
15	Rate Monotonic algorithm and problems	CO2
16	Resource sharing	CO2
17	Resource sharing	CO2
18	Real time operating systems: Features, Process, Threads	CO3
19	Tasks, Kernel, semaphores	CO3
20	Time services, Interprocess communication	CO3
21	Process management, memory management	CO3
22	Device management	CO3
23	File management	CO3
24	IO subsystems management	CO3
25	Interrupt routines	CO3
26	Task scheduling models	CO3
27	Commercial RTOS: Unix based RTOS	CO4
28	Windows as RTOS, POSIX	CO4
29	PSOS, VRTX, VxWorks	CO4
30	Windows CE	CO4
31	Benchmarking real time systems	CO4
32	Real time communication: basic concepts, bounded access protocol	CO5
33	Performance comparison	CO5
34	Real time communication over internet	CO5
35	Scheduling mechansims	CO5
36	Scheduling mechansims	CO5
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48		

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													2	
CO2	3	2	2											2	
CO3	2													2	
CO4	2													2	
CO5	2	2												2	
Articulation Level	2.4	2	2											2	

FACULTY MEMBERS TEACHING THE COURSE (IF MULTIPLE SECTIONS EXIST):

FACULTY	SECTION	FACULTY	SECTION
SNEHA NAYAK	ELECTIVE		

References:

1. Rajib Mall, Real-Time Systems: Theory and Practice, Pearson Education, 2006
2. Jane W. S. Liu, Real Time Systems, Pearson Education, 2006
3. Raj Kamal, Embedded Systems: Architecture, Programming and Design, TMH, (3e), 2014.

Submitted by:

(Signature of the faculty)

Date:

Approved by:

(Signature of HOD)