Pearson BTEC L3 Nationals Extended Diploma

Window for supervised period:
23/04/2019 – 07/05/2019

Controlled hours: 12 hours | Paper Reference **31725H**

Engineering

Unit 6: Microcontroller Systems for Engineers
Client Brief

Part S

You must have: Appropriate hardware (including electronic components), programming and word processing software, a calculator, audio-visual equipment and, if required, the information booklet.

Instructions

- **Part S** should be undertaken in 12 hours under supervision over no more than 5 consecutive working days. The supervised sessions take place in the two-week period timetabled by Pearson.
- **Part S** contains material for the completion of the set task under supervised conditions.
- **Part S** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part S** should be kept securely until the start of the 12-hour supervised assessment period.
- Answer **all** activities.

Information

- The total mark for this paper is 80.
- The marks for **each** activity are shown in brackets
  – *use this as a guide as to how much time to spend on each activity.*

Advice

- Read each activity carefully before you start to answer it.
- Try to answer every activity.
- Check your answers if you have time at the end.

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Instructions to Teachers/Tutors

This paper must be read in conjunction with information on conduct for the task in the unit specification and the BTEC Nationals Instructions for Conducting External Assessments (ICEA) document. For further details please see the Pearson website.

The set task should be carried out under supervised conditions.

Work should be completed on a computer using appropriate hardware and software as listed in the unit content. Learners should complete the electronic task booklet provided by Pearson. This can be downloaded from the Pearson website. Learners must not have access to the internet. One task booklet and one audio-visual recording must be submitted to Pearson on a USB memory stick or a compact disc (CD) for each learner.

Learners will need access to suitable audio-visual recording equipment and the footage should be recorded in an appropriate file format. The recording must be readable through one of the following software applications: Windows Movie, Real Time, VLC or Quick Time. You must save the recordings in one of the following file types: MPEG, FLV, MOV, WMV or RM.

Centres must make sure that all electronic documents are backed up securely and are kept until the end of the post-results service window.

All learner work must be completed independently and authenticated by the teacher/ tutor and/or invigilator before being submitted to Pearson.

Centres are free to arrange the supervised assessment period how they wish provided the 12 hours for producing final outcomes are under the level of control specified, and in accordance with the conduct procedures. The assessment must take place in a two week period set by Pearson, once the learner has started **Part S** the assessment must be completed in 5 consecutive working days.

If learners are to produce a solution to the task using individual electronic components and/or a prototyping board, they may need the Part S Information Booklet. Centres **can** also provide learners with Original Equipment Manufacturers' data sheets for individual electronic devices, e.g. Liquid Crystal Display (LCD) screens and humidity sensors, so that learners can assemble their prototype solution in an appropriate way, but the data sheets **must** not contain any other extraneous hand written information on them.

Refer carefully to the instructions in this task booklet and the Instructions for Conducting External Assessments (ICEA) document to ensure that the assessment is supervised correctly. An authentication statement will be required confirming that learner work has been completed as directed.

Learners must not bring anything into the supervised environment or take anything out without your knowledge and approval. Centres are responsible for putting in place appropriate checks to ensure that only permitted material is introduced into the supervised environment.

Maintaining security

- For **Part S**, learners **must not** have access to the internet.
- During any break materials must be kept securely.
- User areas must only be accessible to the individual learner and to named members of staff.
- Learners can only access their work under supervision.
- Learner work must be backed up regularly.
- Any work learners produce under supervision must be kept secure.
- Any materials being used by learners must be labelled and collected in at the end of each period, stored securely and handed back at the beginning of the next period.

Outcomes for submission

Each learner will need to submit:

(a) An electronic task booklet (in PDF format), which contains the following evidence:

- task planning and system design changes made during the development process
- a technical specification with operational requirements
- a test plan
- details and justifications of input/output devices and hardware selected
- system connection diagrams/schematics
- design of the program structure
- annotated copy of all the code
- test data and analysis.

(b) An audio-visual file (recording) of maximum length of three minutes.

Each learner will need to submit evidence using the file names below:

- Electronic task booklet: booklet_[Registration number #]_[surname]_[first letter of first name]
- Audio visual file: file_[Registration number #]_[surname]_[first letter of first name]

A fully completed authentication sheet must be completed by each learner.

The work should be submitted no later than 09 May 2019.

Instructions for Learners

Read the set task information carefully.

This contains all the information you need to complete each activity in the set task.

You will be given more than one timetabled period to complete these tasks in controlled conditions.

You must plan your time accordingly and be prepared to submit all the required evidence by the date specified.

You will complete this set task under supervision and your work will be kept securely during any breaks taken.

You may use a calculator and will have access to a computer, but not the internet.

You must work independently throughout the supervised assessment period and you must not share your work with other learners.

Your teacher/tutor may clarify the wording that appears in this task but cannot provide any guidance on how to complete the task. You may need to use the Information Booklet.

Outcomes for submission

You will need to submit:

(a) An electronic task booklet (in PDF format), which contains the following evidence:

  • task planning and system design changes made during the development process
  • technical specification with operational requirements
  • test plan
  • details and justifications of input/output devices and hardware selected
  • system connection diagrams/schematics
  • design of the program structure
  • annotated copy of all the code
  • test data and analysis.

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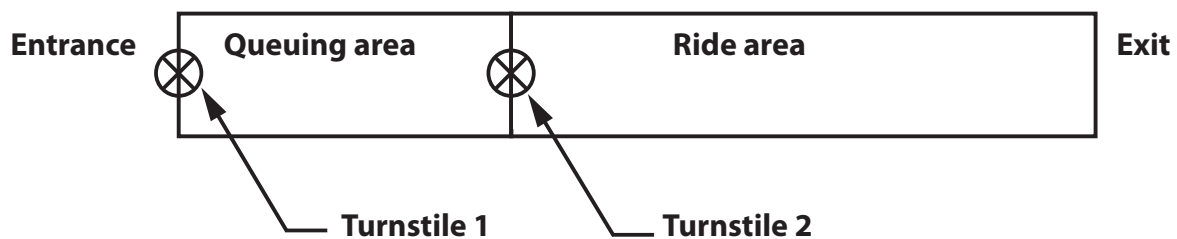
Set Task Brief

Scenario

You are employed by an engineering company that develops monitoring systems to provide a solution to a problem for One90 Theme Parks.

You have been presented with a client brief to develop a prototype monitoring system to check that the queue and ride process in a theme park operates correctly.

Client brief

One90 Theme Parks has a new ride that requires the queue and ride process to be monitored.

To assist you to develop the prototype monitoring system, the client has provided the diagram below of the queue and ride process.

The steps in the queue and ride process are:

1. People arrive at any time into the queuing area through Turnstile 1.

2. An indicator(s) shows the waiting time based on the number of people in the queuing area. The waiting time is 1 minute for every 6 people in the queuing area.

3. When the ride car is empty, Turnstile 2 is unlocked and 6 people enter the ride area.

4. Turnstile 2 is locked.

5. The ride starts automatically and it takes 30 seconds.

6. The ride finishes and the people exit the ride.

7. The process repeats from 2.

To monitor the queue and ride process, One90 Theme Parks has requested a prototype system that will, as a minimum:

*   Count people going through Turnstile 1
*   Indicate the waiting time for the ride
*   Indicate when Turnstile 2 is unlocked or locked.

If a major fault occurs during the queue and ride process, the client would like to have the option to immediately pause the monitoring system.

In developing the prototype system you should consider **enhanced user experiences** and how it would deal with any **unexpected events** that may occur.

Notice

The operation and testing of the prototype system **must** not use:

- Physical turnstiles
- Parts from a theme park ride
- People in a queue.

The client has indicated that the actual working system will deal with a greater number of people and different timings, but they want you to comply with the process steps above for the prototype system.

You need to:

- produce a record of task planning and system design changes made during the development process
- interpret a brief into operational requirements
- design a test plan based on operational requirements
- select and describe appropriate input/output components and how they will work together
- design the program structure
- produce a functional system
- annotate the program or code
- test the system and analyse the outcomes from testing
- produce an audio-visual recording of the system in operation of no longer than three minutes.

Set task

Task

Design, assemble, program and test a safe prototype system to monitor the queue and ride process that meets the requirements of the client brief.

To monitor the queue and ride process, One90 Theme Parks has requested a prototype system that will, as a minimum:

- Count people going through Turnstile 1
- Indicate the waiting time for the ride
- Indicate when Turnstile 2 is unlocked or locked.

If a major fault occurs during the queue and ride process, the client would like to have the option to immediately pause the monitoring system.

The client has **not** specified all the prototype system's functions and constraints. These other functions and constraints are for you, as the developer, to determine and justify. For example, the client has not set a maximum size for the queuing area.

You must follow an appropriate development process and use a microcontroller.

You will have a total of 12 hours to complete your prototype system (including testing, documentation and audio-visual recording) which may be split into several shorter periods.

Health and safety notice

Standard health and safety procedures **must** be followed at all times.

The operation and testing of the prototype system **must** not use:

- Physical turnstiles
- Parts from a theme park ride
- People in a queue.

The stages below will help you to structure your development work.

Activity 1

Task planning and system design changes

You are advised to spend no longer than 1.5 hours on this activity.

- At the start of the task, create a short project time plan/Gantt chart and use it to monitor your progress throughout the rest of the task and make any adjustments as required.
- During the other activities (2 to 5), you should also record in the Activity 1 section of your electronic task booklet:
  - What you did in the session.
  - Details of any issues encountered and solutions discovered.
  - Action points for the next session.

(Total for Activity 1 = 10 marks)

Activity 2

Analysis of the brief

You are advised to spend no longer than 1.5 hours on this activity.

- By interpreting the client brief into operational requirements, prepare a technical specification for a user friendly system that can handle some unexpected events.
- Prepare a test plan to check the functionality of the final solution against the technical specification and include some unexpected events.

(Total for Activity 2 = 9 marks)

Activity 3

System design

You are advised to spend no longer than 2.5 hours on this activity.

Prepare a user friendly system design that can handle some unexpected events, including:

- The selection and justification of suitable input and output devices
- A description of the system design covering input and output devices and microcontroller connections
- A plan for the program structure detailing key system operations.

(Total for Activity 3 = 16 marks)

Activity 4

System assembly and programming

You are advised to spend no longer than 2.5 hours on this activity.

Develop a user friendly system that is well organised, structured and formatted, including:

- Producing the software program and annotating the code
- The assembly of any hardware (if required)
- Refining the system so that it operates as expected and can handle some unexpected events.

Once completed, insert the annotated code into the electronic task booklet.

(Total for Activity 4 = 16 marks)

Activity 5

System testing and result analysis

You are advised to spend no longer than 1.5 hours on this activity.

- Test the system using the test plan (from Activity 2) and include some unexpected events.
- Record the outcome of each test in the template provided.
- Analyse the test results and evaluate the system for conformance against the client brief.

(Total for Activity 5 = 9 marks)

Activity 6

System in operation

You are advised to spend no longer than 2.5 hours on this activity.

Produce an audio-visual recording that demonstrates the system in operation, which should include:

- Your name, learner registration number and centre number at the start
- A commentary explaining the operation of the user friendly system and how its behaviour is linked with your chosen hardware and the software program
- Recorded evidence of the outcome from suitable tests including some unexpected events (from Activity 5).

(Total for Activity 6 = 20 marks)

(TOTAL FOR TASK = 80 MARKS)