PROGRAM: NATIONAL DIPLOMA
ENGINEERING METALLURGY

SUBJECT: PHYSICAL METALLURGY II

CODE: PMY22-2

DATE: MID-YEAR EXAMINATION
17 JUNE 2014

DURATION: (X-PAPER) 08:30 – 11:30

WEIGHT: 40 : 60

FULL MARKS: 130

TOTAL MARKS: 130

EXAMINER: Dr S C DU PLESSIS

MODERATOR: MR C PALINHOS

NUMBER OF PAGES: 3

INSTRUCTIONS: ANSWER ALL QUESTIONS
QUESTION 1

After being slowly cooled from the austenite region, a simple iron-carbon steel exhibits a microstructure consisting of 40 percent pearlite and 60 ferrite.

(a) Estimate the carbon concentration of the steel.
(b) Describe the equilibrium microstructure that would be obtained if the steel were heated to 730°C and held there for a long period of time.
(c) What would be the equilibrium structure of this steel if it were heated to 850°C?
(d) Make sketches of all these microstructures. (20 marks)

QUESTION 2

(a) Explain in detail how bainite differs from martensite and from pearlite
(b) How do upper and lower bainite differ? (15 marks)

QUESTION 3

In certain cases the grain size of a metal may be of the order of several tenths of a μm. Approximately, what is the ASTM grain size number of a metal whose grain size is 0.2 μm? (15 marks)

QUESTION 4

Describe the following terms:

(i) Spheroidize annealing
(ii) Proeutectoid ferrite
(iii) Hot-short
(iv) Cold-short
(v) Temper brittleness
(vi) Hot-hardness
(vii) Heat checks
(viii) Steadite
(ix) Transition temperature
(x) Uniform corrosion (10 marks)

QUESTION 5

Clearly describe what is meant by Cathodic Polarization? Showing diagram (10 marks)
QUESTION 6

(a) Explain the phenomena taking place on this high carbon annealed steel (Figure 1)
(b) Show the equation for this reaction.
(c) Where are this phenomena a problem
(d) How can it be prevented

(20 marks)

Figure 1.

QUESTION 7

Describe the physical metallurgy and mechanical properties of gray cast iron. (30 marks)

QUESTION 8

Describe the development of a cup-and-cone fracture of a tensile specimen (10 marks)

TOTAL MARKS: 130