MECHANICAL ENGINEERING

1.Write critical notes on any four of the following: (4x7½=30)

(a) Sketch crank rocker mechanism and show by sketches, how it is used in a shaping machine for feeding the work piece.

(b) Austemper Ductile Iron (ADI) and its uses

(c) Dislocation and Dislocation density

(d) Laser cutting

(e) Break even analysis

(f) EDM and ECM

PART I

2.(a) A rectangular beam is to be cut from a circular log of wood of diameter D. Find the dimensions of the strongest section in bending. (10)

(b) Draw phase diagram of steel portion of Fe-C system and explain the microstructure of eutectoid hypoeutectoid and hypereutectoid steel. (10)

(c) What is the principal difference between natural and artificial aging process? (10)

3.(a) Briefly explain the difference between hardness and hardenability. (10)

(b) What influence does the presence of alloying elements (other than carbon) have on the shape of hardenability curve? How is this effect beneficial? (10)

(c) Why does chromium in stainless steel make them more corrosion resistant in many environments than plain carbon steel? (10)

4.(a) Explain the types of manufacturing operations where CPM and PERT systems are most applicable. (10)

(b) What is value analysis? Apply this analysis for manufacture of exhaust valve of an I.C.E. (10)

(c) Sketch a Jig to be employed for manufacture of flange of flanged coupling. (10)

PART II

5.(a) Explain Stefan-Boltzman's law of heat transfer by radiation. (15)

(b) Derive an expression for the percentage change in the efficiency of air standard Diesel cycle for given percentage variation in specific heat. (15)

6.(a) A general heat engine has a total heat input of 1.3 kJ and thermal efficiency 35%. How much work will it produce in KJ? (15)

(b) A heat pump has a COP of 1.7. Determine the heat (i) transferred to and (ii) from this heat pump in kJ when 50 kJ of work are applied. (15)

7.(a) Calculate specific volume of dry air, M=28.97, that is contained in a compressed air tank at an absolute pressure of 200 kPa and temperature of 100^0C. (15)

(b) Derive an equation for the specific work produced when an ideal gas undergoes a reversible polytropic process (n=1) in a single inlet-outlet, steady flow system. The final result should be in terms of the inlet and outlet pressures and the inlet temperature. (15)